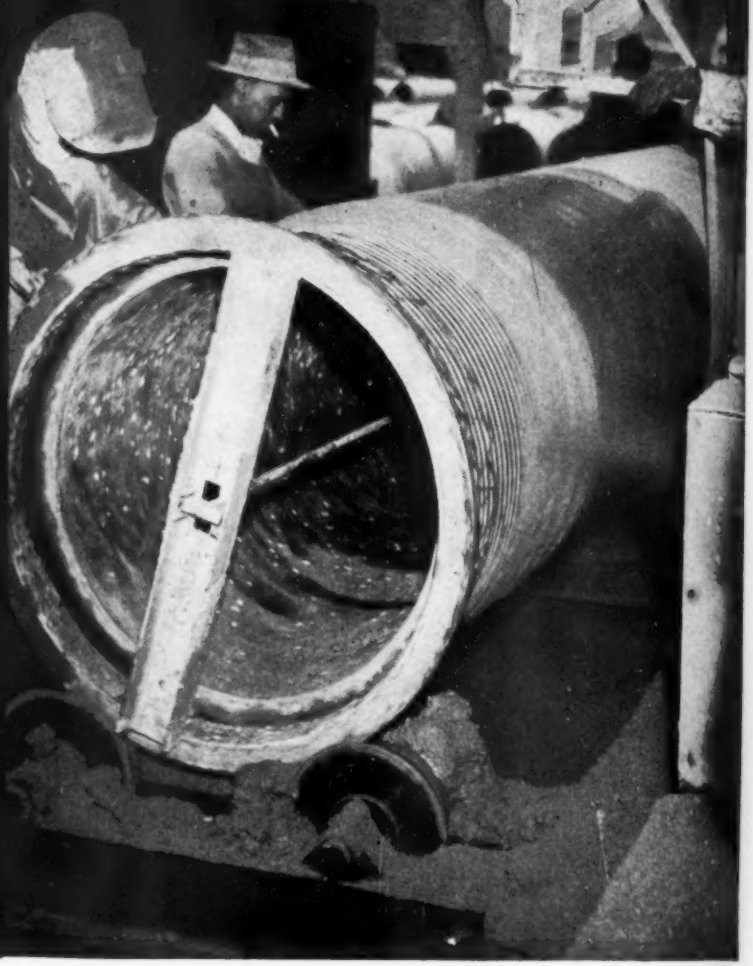
WATER & SEWAGE WORKS

COLDSTREAM GUARDS

ettling the River Lea in Attempt to Save London's Water Supply.

ADVANTAGES OF PRESTRESSED CONCRETE CYLINDER PIPE • NO. 4

Maximum use of local labor and materials...



• The installation of Prestressed Concrete Cylinder Pipe offers no exception to the Lock Joint Pipe Company's general practice of setting up temporary manufacturing plants near the location of projects—and using a maximum of local labor and local materials.

All necessary equipment for the manufacture of this high head pipe is transported to the temporary plant where the cylinder is fabricated, tested and lined with a substantial thickness of concrete. After a proper curing period, the lined cylinder is tension wrapped with high tensile wire and protected from corrosion by a mortar coating.

Experience on major installations in various parts of the country has proven that Lock Joint Prestressed Concrete Cylinder Pipe offers many important advantages — higher pressures in a greater range of sizes, increased elasticity, minimum weight, excellent performance and maximum water-tightness. You can profit by this experience if you consult us on all your pipeline problems.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT Reinforced Concrete PRESSURE PIPE

LOCK JOINT PIPE COMPANY

Established 1905

P. O. BOX 269, EAST ORANGE, NEW JERSEY

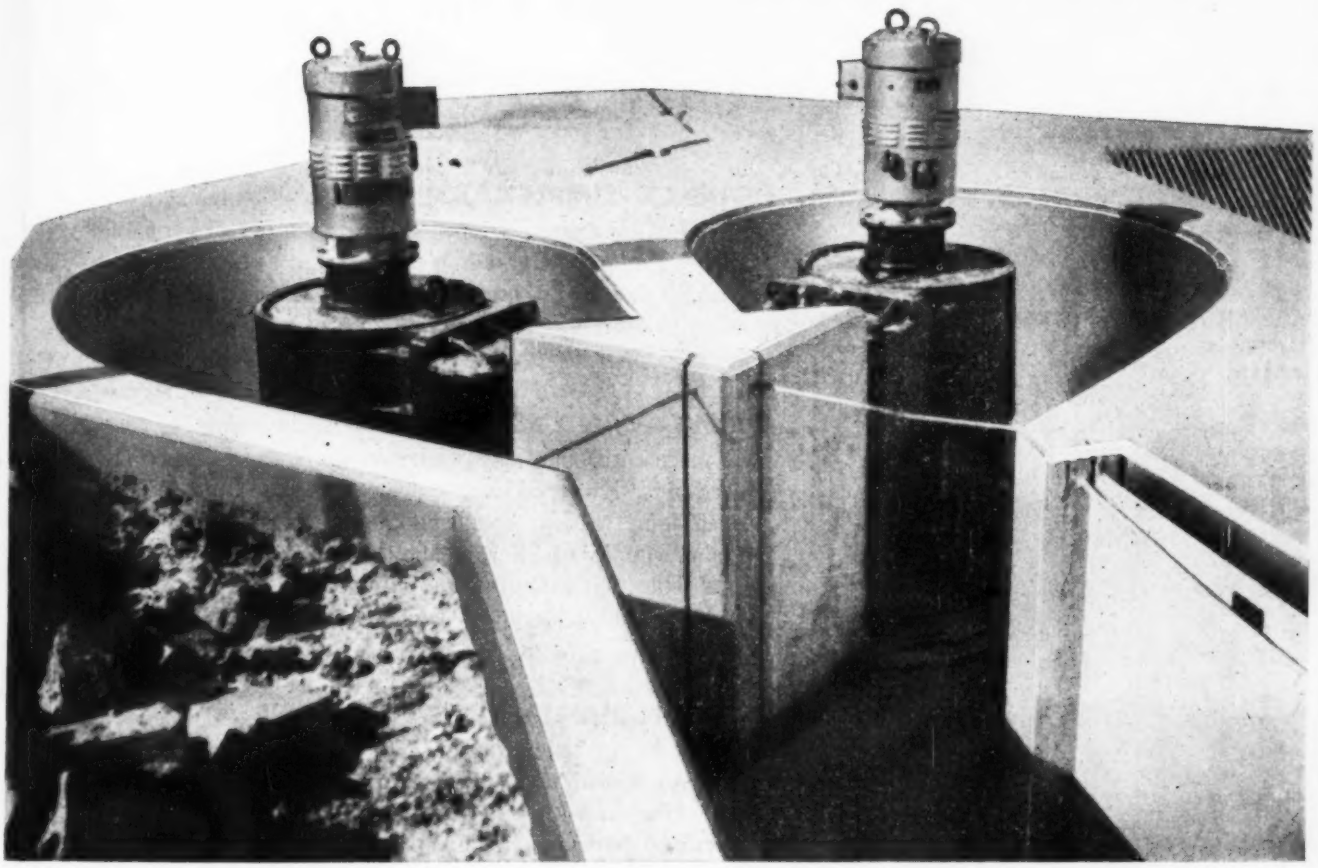
Denver, Colo. · Chicago, Ill. · Kenilworth, N. J. · Kansas City, Mo. · Rock Island, Ill.
Joplin, Mo. · Valley Park, Mo. · Cleveland, Ohio · Hartford, Conn. · Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

WATER AND SEWAGE WORKS, May, 1947. Volume 94. Number 5. Published monthly by Gillette Publishing Co., 22 West Maple St., Chicago 10, Ill. Per copy, 25c. Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.

Comminutors are Standard Equipment for Screening and Cutting Sewage Solids

Because-



- It cuts sewage solids into small particles that will pass through the drum slots.
- Scientifically designed and engineered — close tolerances insure shearing of rags and stringy material.
- Stellite cutting edges provide long, abrasion-resistant life.
- Comminuted particles settle rapidly . . . improve sedimentation and sludge digestion.
- Labor costs reduced . . . no raking, removal, hauling, burial or incineration of foul screenings.
- Lubrication, periodic inspection and cutter sharpening only maintenance required.
- Fly nuisance, odors and unsightly appearance eliminated.
- Power requirements negligible. Inertia effect of drum does cutting.
- Housing not required . . . comminutor is designed for all-weather outdoor service.
- Comminutors in operation continuously for more than fifteen years, establish their dependability. More than 1500 installations to date.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

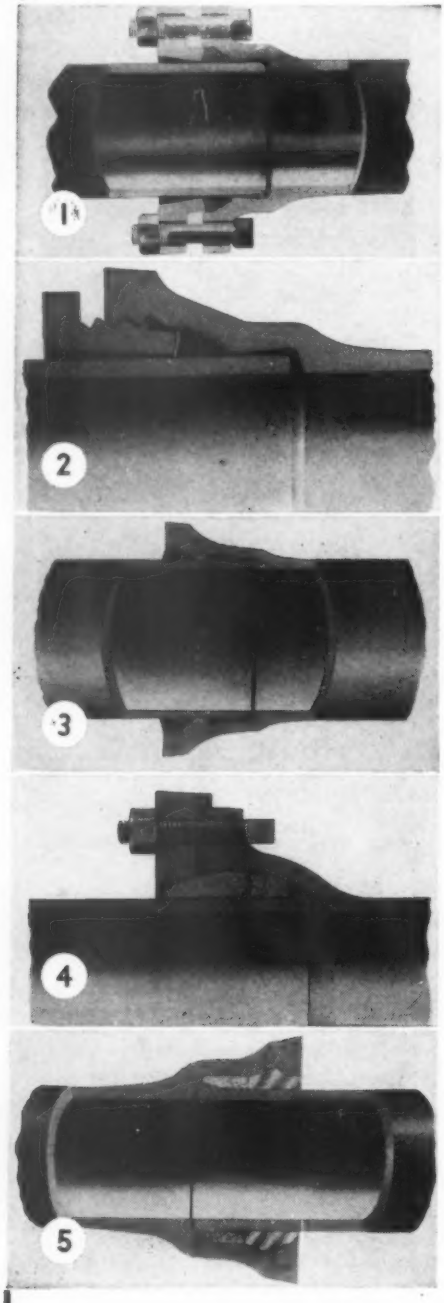
Flush-Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

THESE 5 JOINTS

Supplied with Mono-Cast Centrifugal Pipe

MEET VARYING ENGINEERING & INSTALLATION NEEDS



1. DOUBLEX SIMPLEX JOINT PIPE — A standardized mechanical joint pipe equipped with stuffing box type of joint having a ring gasket, cast iron gland, and cast iron bolts. Scientifically designed to meet the exacting requirements of low, medium and high-pressure service in handling gas and liquids.

2. SCREW-GLAND JOINT PIPE — An all-purpose economical, mechanical joint pipe suitable for water, gas, oil and other fluids, developed in answer to the demand for a rubber-packed joint without bolts suitable for normal service and pressure conditions. Screw-Gland Pipe provides for liberal lateral deflection and provision for expansion and contraction of the pipe line without leakage.

3. ROLL-ON-RUBBER RING JOINT PIPE — Designed as an alternate for bell and spigot pipe for conveyance of water, sewage or similar liquids. It is quickly and easily assembled by unskilled labor and after assembly the joint will easily deflect and remain tight under pressure.

4. MOLOX BALL AND SOCKET JOINT PIPE— An exclusive Acipco development, designed for river crossings and other installations requiring excessive joint deflection. It is positively locked against joint separation and remains bottle tight under pressures up to several hundred pounds per square inch at any angle within the range of deflection for which it is designed.

5. STANDARD BELL AND SPIGOT PIPE — Used under normal service conditions, the standard bell and spigot joint will give long and dependable service. The joints of bell and spigot pipe are made up of lead and jute, cement, or any other special jointing material customer may desire to use. It is supplied in diameters 3″ through 48″ inclusive.

AMERICAN CAST IRON PIPE COMPANY

Birmingham 2, Alabama

Davey Valves Assure PERMANENT PEAK EFFICIENCY

Any compressor will run perfectly when it is new... and will produce its rated air capacity.

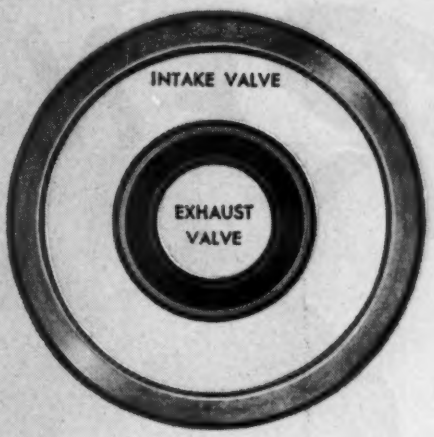
The real test of quality comes with increasing age... the manner in which a unit operates after 5-10-15 years of service. This depends 100% on valve efficiency.

In Davey Compressors permanent peak valve efficiency is the result of providing a ready path for heat removal through aluminum alloys. These alloys transmit heat through their mass three times as fast as cast iron.

Consequently, Davey units operate at constant peak efficiency—longer and more economically.

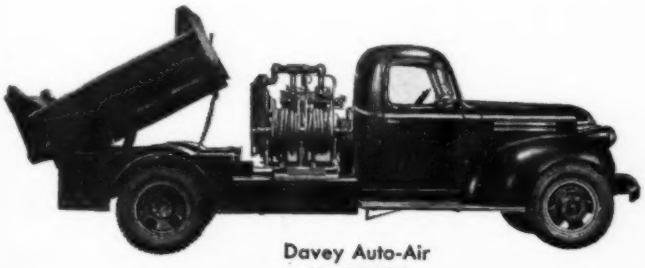
Davey is your best compressor investment—both for today and tomorrow. See your Davey dealer now. Ask him to tell you more about Davey valves—also, how vibration has been "engineered out" of the Davey line for '47.

P & P-118



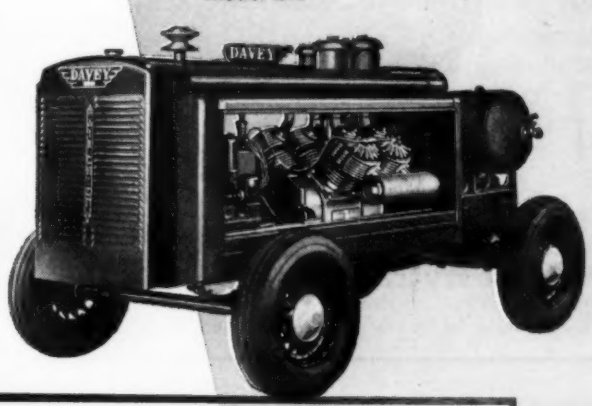
AFTER 13 YEARS of continuous service, these valves were recently removed from a Davey Compressor.* Their peak-efficiency condition is attested by the absence of carbon or pitting. Note how they have obviously seated perfectly—the complete absence of any signs of leakage . . . after 13 years.

**Owner's name on request.*



Davey Auto-Air
Model 105

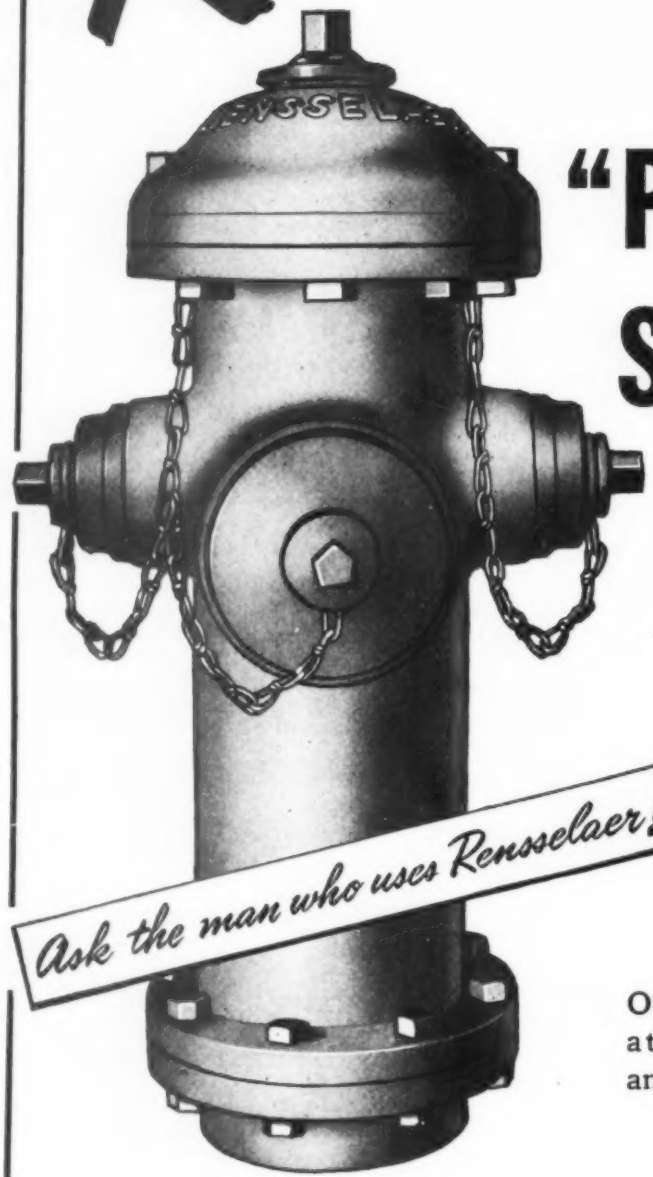
Davey Air Chief
Model 210



DAVEY

DAVEY COMPRESSOR CO.
KENT, OHIO

RENSSELAER Defender



"PUBLIC SERVANT No. 1"

. . . will still be serving your great, great grandchildren as dependably as it serves *you* today.

Write for Bulletin W

Our factory-trained representatives make regular calls and are anxious to serve you.

Combines Utility and Dependability with modern streamlined appearance. A Fire Hydrant of which you can be proud!

ATLANTA, GA.
17 Edgewood Ave., S.W.
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725 Kenmare Road
CHICAGO, ILL.
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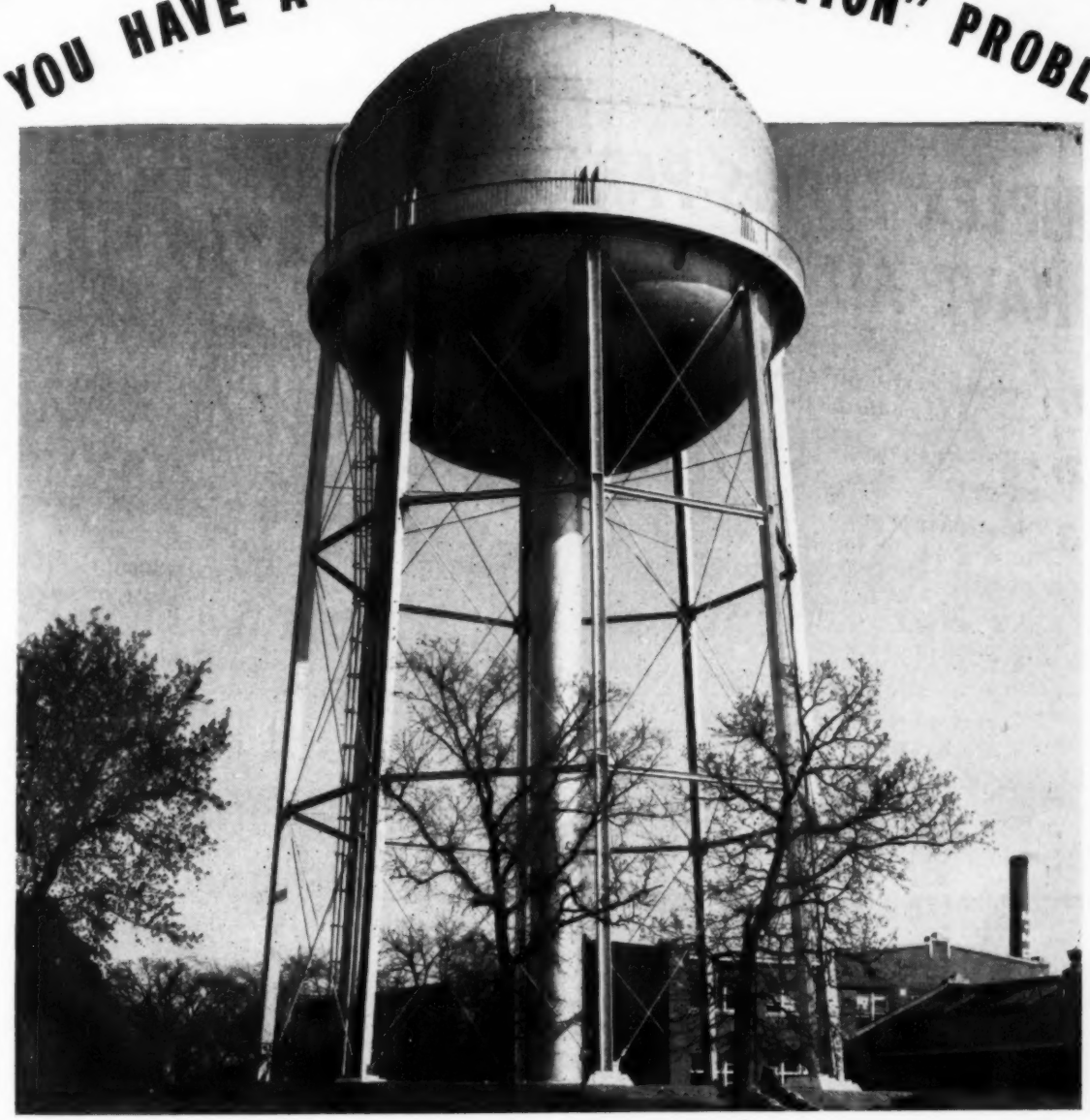
HORNELL, N. Y.
38 Main St.
LOS ANGELES, CALIF.
Subway Terminal Bldg.
MEMPHIS, TENN.
519 Farnsworth Bldg.
OKLAHOMA CITY, OKLA.
817 Braniff Bldg.
PITTSBURGH, PA.
2203 Oliver Bldg.
SAN FRANCISCO, CALIF.
115 Townsend St.
SEATTLE, WASH.
1252 First Ave., South
WACO, TEXAS
206 Franklin Ave.

RENSSELAER VALVE CO.

TROY, N. Y.

DO YOU HAVE A "PRESSURE VARIATION" PROBLEM?



SOME cities do, but Horton elevated water storage tanks have solved it for many municipalities. At Hopkins, Minnesota, where the 500,000-gal. Horton elevated tank shown above was recently installed, minimum and maximum pressures throughout the distribution system are now virtually the same. A recent report indicates that pressure remains practically constant at 45 lbs. per sq. in.

With automatic regulating controls, the variation of the water level in the tank may be kept to within a few feet. This gives more uniform pressure in the system under normal draft conditions. The advantages of Horton elevated tanks for water storage do not stop with the *smoothing out* of pressure variations. Other advantages are: lower pumping costs, more dependable supply of water for fire protection, maintenance of pressure during temporary power failure and lower insurance rating for the city.

The water for the Hopkins distribution system is pumped from two wells by two 500 gpm pumps. There are 1¼ mi. of 8-in. distribution mains in the system and 7 mi. of 6-in. and 4-in. transmission mains. The city has a total of 580,000 gals. of elevated storage capacity. The 1200 customers use an average of 392,000 gals. per day.

When you are faced with the problem of smoothing out pressure fluctuations in a municipal water distribution system (or you desire to secure some of the other benefits of elevated storage mentioned above) write our nearest office for quotations on Horton elevated water storage tanks.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th St.
Atlanta 3.....2181 Healey Bldg.
Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Dr.
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Havana.....402 Abreu Bldg.
San Francisco 11.....1283-22 Battery Street Bldg.
Detroit 26.....1551 Lafayette Bldg.
In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

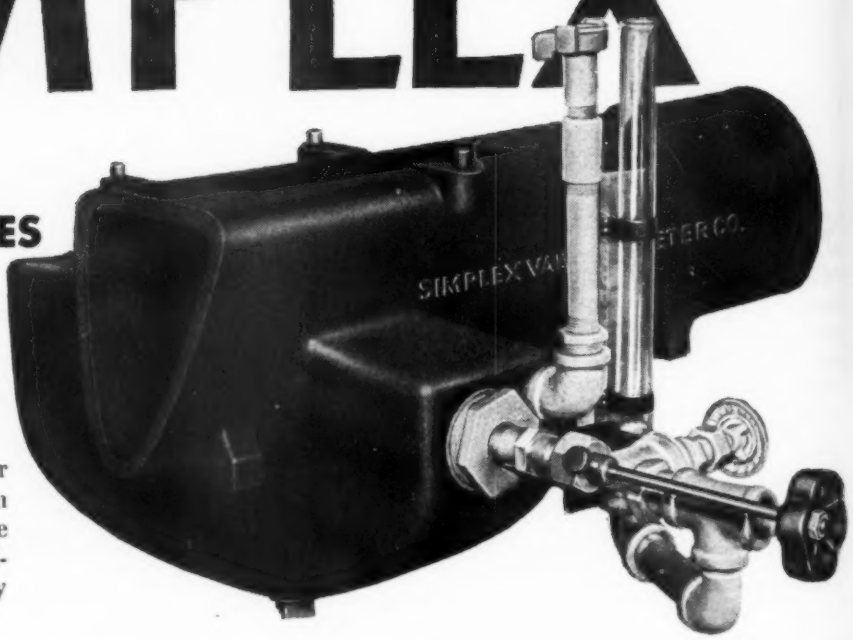
For open flow of water, sewage, industrial liquids . . .

SIMPLEX TYPE S-PARABOLIC FLUME METERS HAVE ALL THESE GREAT ADVANTAGES!

1. Compact cast iron measuring section—ready to place in the line.
2. Self-scouring design permitting passage of sediment or solids.
3. No pockets or grooves in measuring section to clog up or facilitate accumulation of matter.
4. No straight section of pipe on exact grade required upstream of flume casting.
5. Can be attached to larger pipe sizes by eccentric reducer thereby saving installation costs.
6. Operates under extreme low head and low flow conditions.
7. Small head loss—requires very little free fall at outlet.
8. Generous capacity to handle high—as well as low flows.
9. Ability to measure over long flow range—from maximum to 5% of maximum.
10. Mechanical or electrical transmission from flume to meter with indoor or outdoor installation as desired.
11. Available in sizes 6" diameter to 36" diameter inclusive.

SIMPLEX

TYPE-S
PARABOLIC FLUMES



Send for your copy of Bulletin 210 — complete operation, installation, capacity data

SIMPLEX VALVE & METER COMPANY
6743 UPLAND STREET, PHILADELPHIA 42, PA.

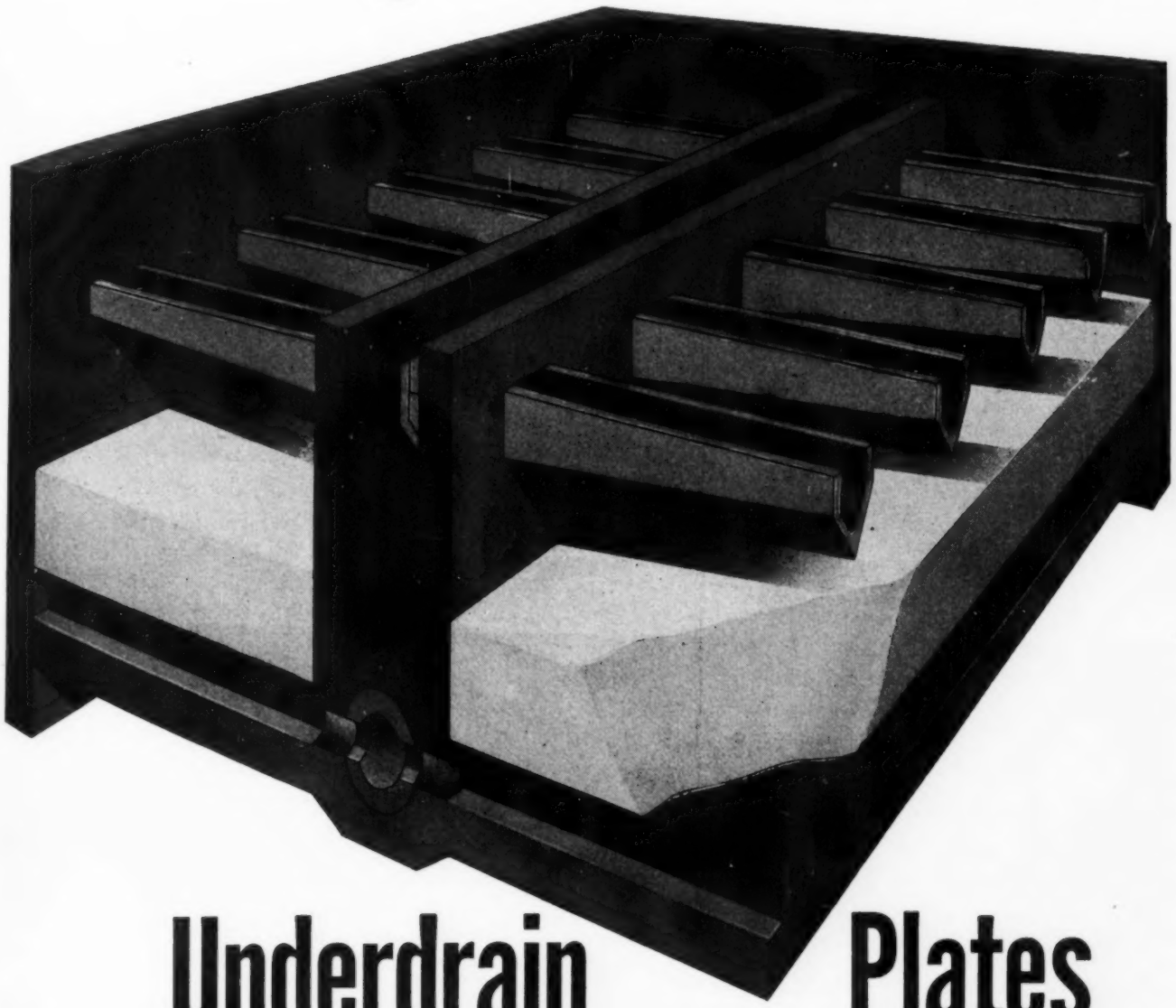
Simplicity Keynotes THIS Underdrain System

SIMPLE TO INSTALL. The ALOXITE aluminum oxide porous plate underdrain system is adaptable to large or small gravity and pressure units. It can be fitted into both new and old structures.

SIMPLE TO OPERATE. With all graded gravel eliminated, there is no displacement of filter bed. Filtration is more efficient. Backwashing is always complete and uniform. This operation usually requires less water and is accomplished in shorter time. Filtering and backwash operating heads, too, are reduced.

SIMPLE TO MAINTAIN. There is only one material to handle. The costly and tedious job of regrading sand and gravel is avoided. If required, bottom inspection is made quickly and easily. Repairs and replacements of spray nozzles, laterals, etc., are unnecessary as such metal parts are not required.

Our engineers will gladly explain, in more detail, how you might profit by utilizing the ALOXITE underdrain system. Immediate attention will be given your inquiries directed to Department O-57, The Carborundum Company, Refractories Division, Perth Amboy, N. J.



Underdrain Plates

BY CARBORUNDUM

TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

Can you think

There's a fortune in it if you can.

But remember, we mean pipe material that *will* serve a century. Everybody knows that cast iron pipe will because it *has* served for more than a century in American cities, and for more than two centuries in Europe.

Can you think of any other kind that will? Under the ground and under pressure? At practicable cost? No one else has been able to.

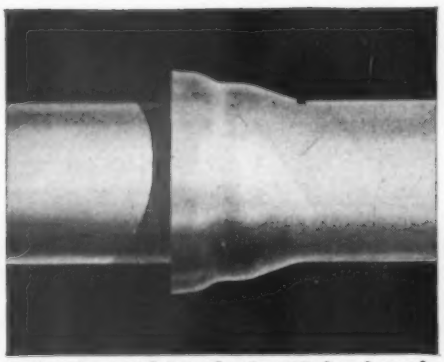
But, you may say, in this Atomic Age why should I buy pipe that lasts so long? Because the same qualities that enable cast iron pip to serve for centuries also mean economy "in our time." Lower annual maintenance cost from the start. Lowest cost per service year in the end.

A survey among 195 water works superintendents proves that the maintenance cost of cast iron pipe for distribution mains is lowest by far.

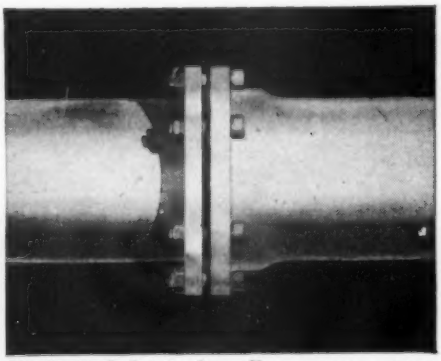
Engineers, in evaluating bids, continue to give cast iron pipe the highest rating for useful life—100 years or more.

A U. S. Government Report On Obsolescence gives cast iron pipe the lowest rate of depreciation of all engineering materials.

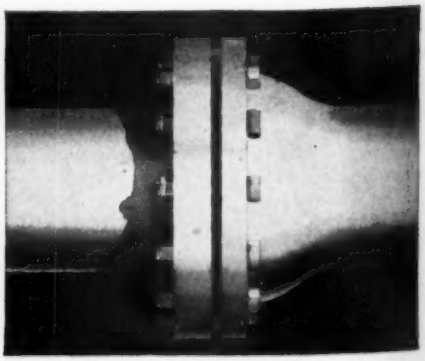
Yes, you can lay cast iron pipe with confidence, underground or under water. Because of its all-purpose adaptability, cast iron pipe is available with joints for every service as shown below. Cast Iron Pipe Research Association, T. F. Wolfe, Research Engineer, Peoples Gas Bldg., Chicago 3.



Bell-and-spigot Joint—the time-tried and standard for water, gas and sewerage service.



Mechanical Joint—for all pressures—now standardized with interchangeable parts.



Flexible Joint—for river crossings and other sub-aqueous installations.

CAST IRON PIPE

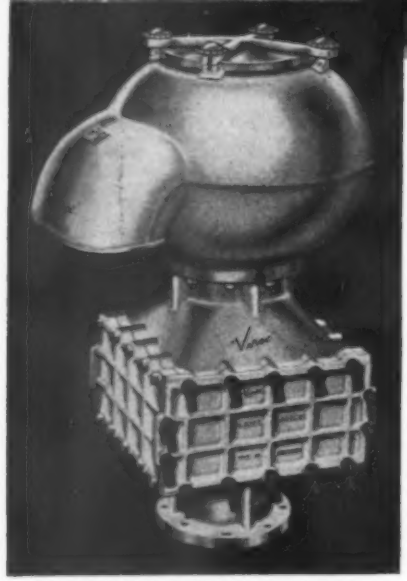
of any other pressure pipe material, practicable for underground mains, that will serve for a century?

Flanged Joint—for water, steam, oil or gas lines, generally used above ground.

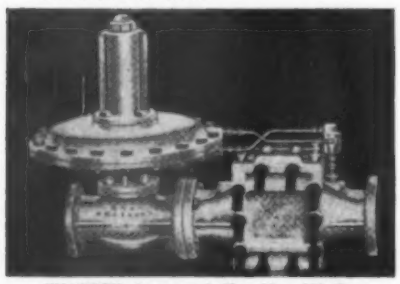
Serves for Centuries

MODERN SEWAGE DISPOSAL PLANTS USE "VAREC" approved EQUIPMENT...

PHOTO—Courtesy Dorr Company, New York, N. Y.



"VAREC" Approved Fig. No. 58C Pressure Relief and Vacuum Breaker Valve with Flame Arrester.



"VAREC" Approved Fig. No. 440 Pressure Relief and Flame Trap Assembly.

HERE'S A TYPICAL SMALL PLANT INSTALLATION SERVICING A CITY OF SLIGHTLY OVER 4,000 POPULATION

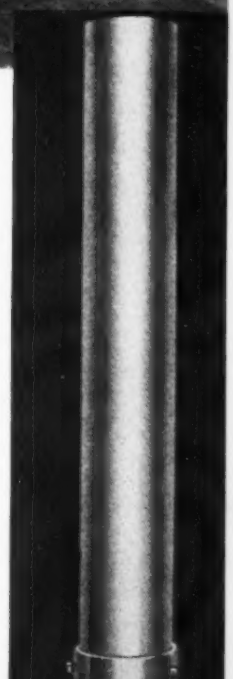
Adequate protection against fire hazard in this plant is obtained with a "VAREC" Approved Pressure Relief and Vacuum Breaker Valve with attached Flame Arrester on each Digester. Waste gas is burned with a "VAREC" Approved Waste Gas Burner. Predetermined back pressure throughout the system and prevention of flame propogation is achieved with a "VAREC" Approved Pressure Relief and Flame Trap Assembly. These and other "VAREC" Approved Gas Control Equipment have all been tested and proved. A complete line of this equipment is fully described in Catalog S-3 along with valuable engineering data. *Write for your copy today.*

THE VAPOR RECOVERY SYSTEMS CO.
COMPTON, CALIFORNIA, U.S.A.

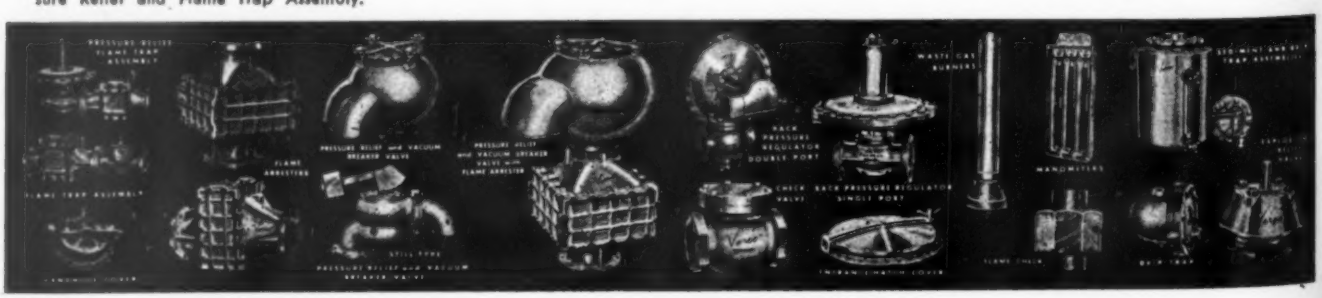
New York, N. Y. — Chicago, Illinois — Cleveland, Ohio — Houston, Texas

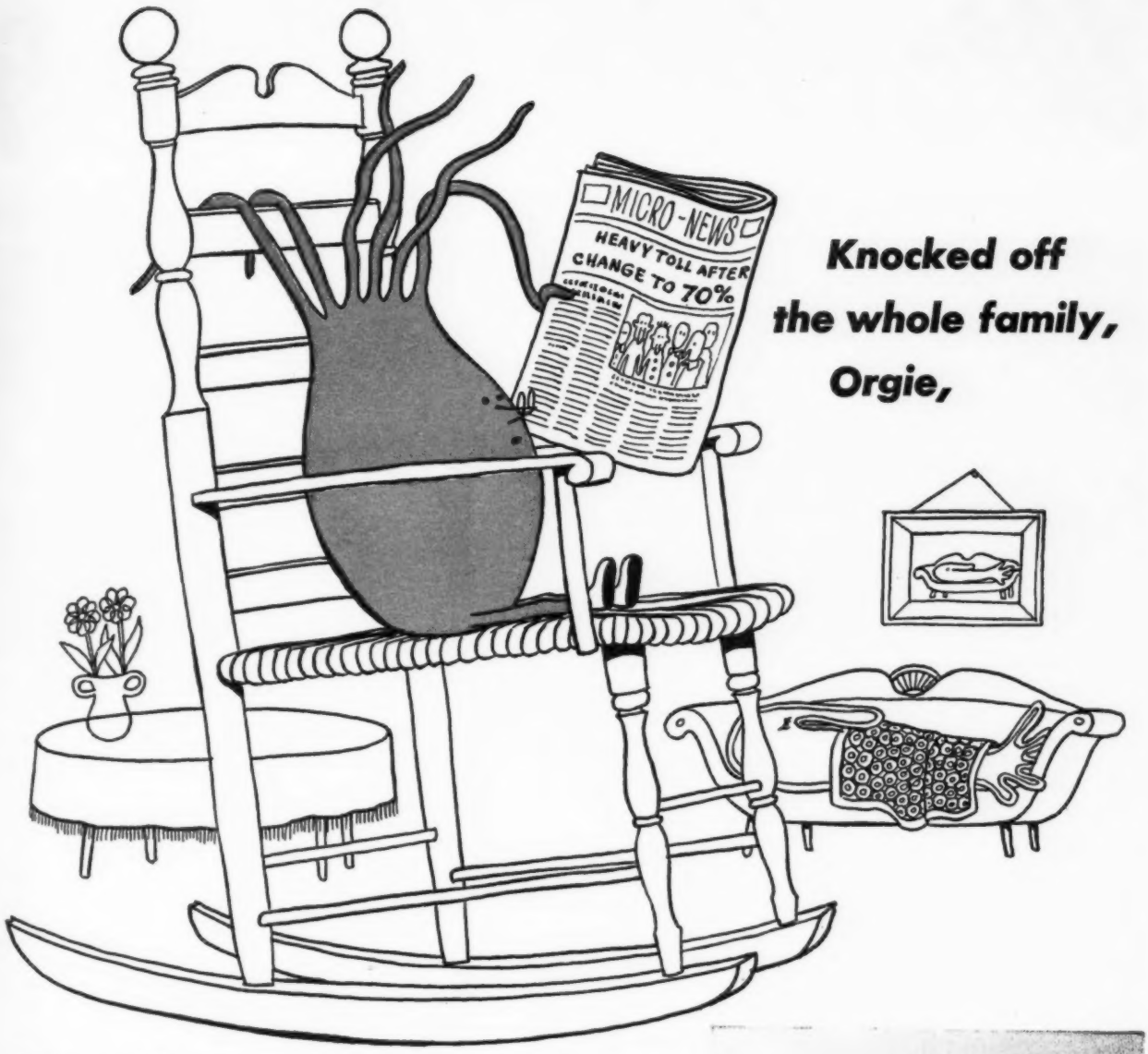
Agencies Everywhere — Cable Address "VAREC" Compton
All Standard Codes

The Pace Setter Since 1928



"VAREC" Approved Fig. No. 237 Waste Gas Burner.





Knocked off the whole family, Orgie,

must have been

PITTCHLOR*

That's right Orgie—PITTCHLOR is lethal for entire colonies of chlorine-susceptible microorganisms, bacteria and algae. This 70% available-chlorine calcium hypochlorite is superb for the chlorination of water supplies; for sewage treatment and for a wide variety of general sanitation uses. It is a dry, white, free-flowing, granular material that is easy to use either manually or through relatively simple mechanical feeders.

**Reg. U. S. Pat. Office*

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 3¾ lb. cans (12 per case) and 100 lb. drums. Write for descriptive literature covering the uses in which you are interested.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION

FIFTH AVE. at BELLEFIELD — PITTSBURGH 13, PENNA.

CHICAGO • BOSTON • PITTSBURGH
ST. LOUIS • MINNEAPOLIS • CHARLOTTE
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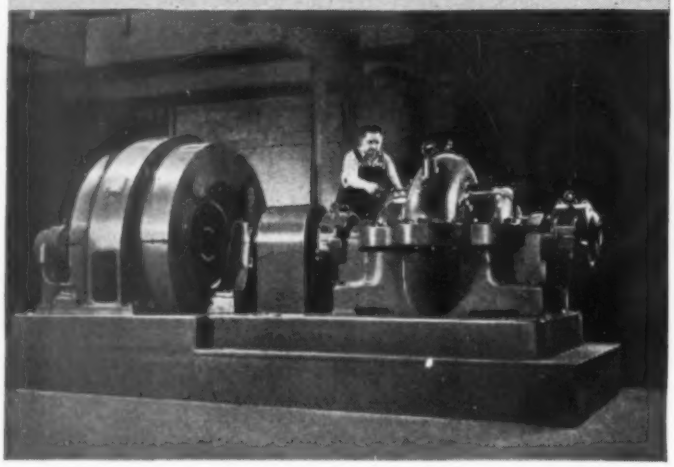
COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS

Soda Ash • Caustic Soda • Liquid Chlorine • Sodium Bicarbonate • Pittchlor (*Calcium Hypochlorite*) • Silene EF (*Hydrated Calcium Silicate*) • Calcium Chloride • Soda Briquettes (*Iron Desulphurizer*) • Modified Sodas • Caustic Ash • Phosflake (*Bottle Washer*) Calcene T (*Precipitated Calcium Carbonate*)

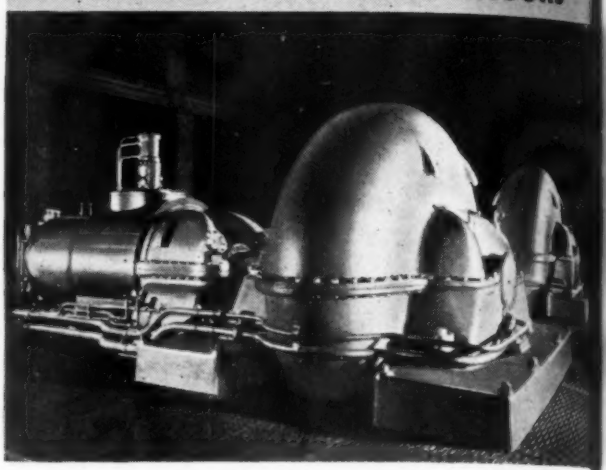
World's Widest

CENTRIFUGAL PUMPS



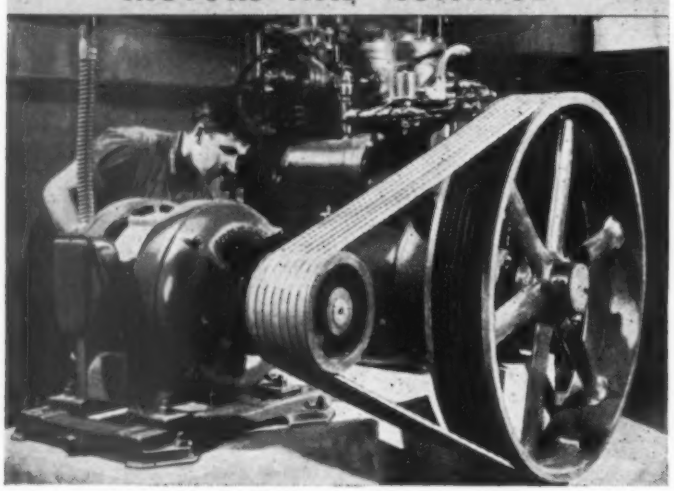
MIDWEST PUMPING station uses Allis-Chalmers pump-motor "team." A-C builds *all types of pumps for water and sewage works, fire protection, drainage and other public works.* Capacities range up to the largest. A-C can also supply any type and size of motor or steam turbine drive.

BLOWERS AND COMPRESSORS



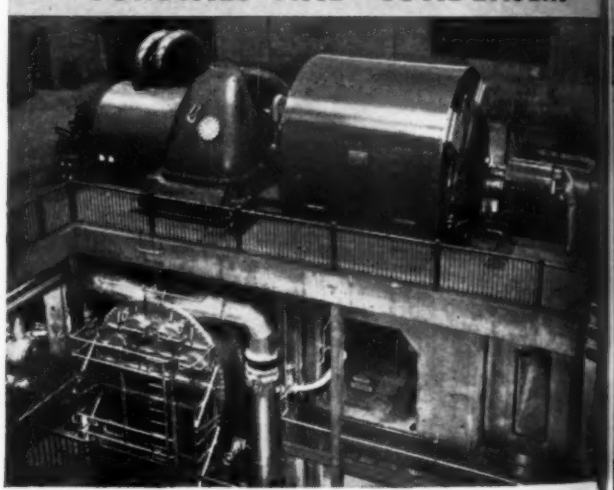
ALLIS-CHALMERS turbine-driven centrifugal blowers in Milwaukee sewage treatment plant. A-C builds multi-stage blowers up to 130,000 cfm, 35 psig; single-stage—600 to 35,000 cfm. 1 to 6.25 psig; rotary compressors—44.5 to 1,684 cfm, 5 to 35 psig; vacuum pumps—14.5 to 5,300 cfm, 18 to 28.5 in. hg.

MOTORS AND CONTROL



GENERAL OR SPECIAL purpose motors from *1 hp to 7,000 hp and over* are built by Allis-Chalmers. Motor control is also available to fulfill any requirement. And famous Texrope V-belt drives fit applications of power transmission from *fractional to 6,000 hp,* constant or variable speed.

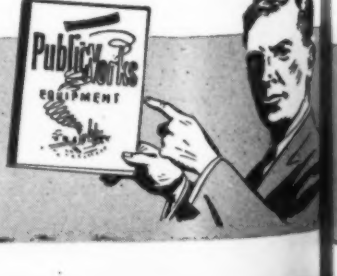
TURBINES AND CONDENSERS



POWER PLANT INSTALLATION in Lansing, Michigan equipped with Allis-Chalmers turbine and condenser. For over 40 years A-C has been providing power stations with *all types and sizes* of steam turbines and condensers. Auxiliaries include air ejectors, circulating water, condensate, and boiler feed pumps.

Send for NEW Public Works Bulletin

Description of A-C equipment — published for Public Works engineers. Send for your copy today. Bulletin 25B6607, ALLIS-CHALMERS, MILWAUKEE 1, WIS.



Range OF MAJOR PUBLIC WORKS EQUIPMENT!

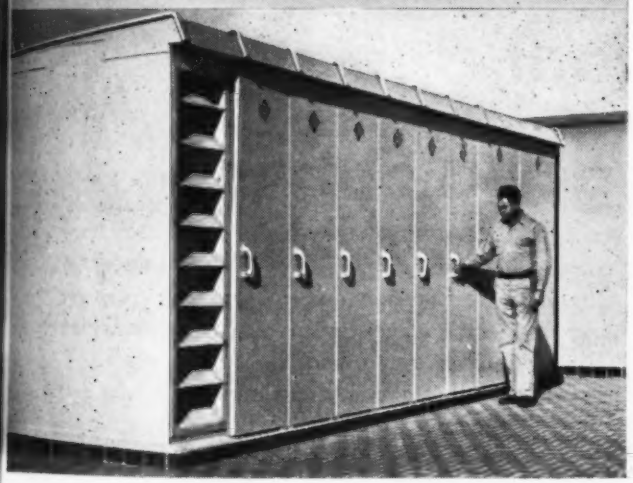
At Allis-Chalmers You Get Complete Line Ranging from Power Generation to Processing Machinery

WHAT DOES THIS LEADERSHIP in range of public works equipment mean to you? It means that you can get individual units of equipment *tailor-made to work together* . . . designed and built by one company.

Engineers know that for maximum efficiency, equipment must work as a team—*the right drive for the right pump—the right control with the right motors.* It is this coordination of equipment that saves you money and engineering worries. No other company offers you this kind of equipment engineering. No other company can supply you with so many different types of major equipment with emphasis on making them work together as an efficient team.

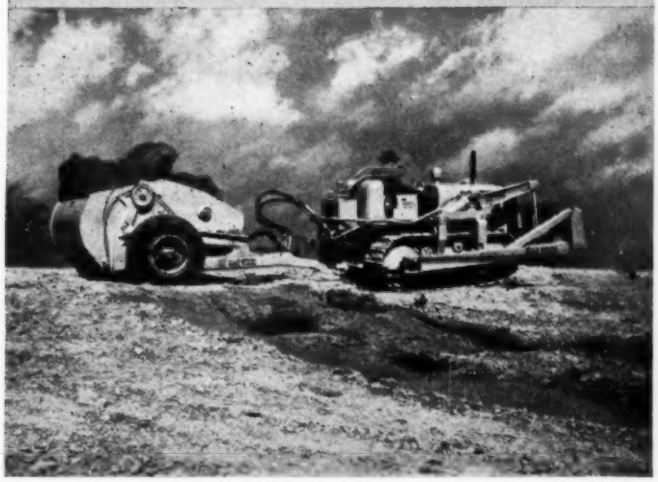
Whether you are planning to modernize or expand, call on Allis-Chalmers. Get in touch with your nearest A-C office or write to ALLIS-CHALMERS, MILWAUKEE 1, WIS.

POWER DISTRIBUTION



PROTECTING MOTORS in West Coast pumping station—that's the important job of this Allis-Chalmers metal-clad switchgear. Completing the Allis-Chalmers power distribution line are transformers, circuit breakers, unit substations, motor generator sets, mercury-arc rectifiers, switchboards and industrial control.

HIGHWAYS AND PROCESSING

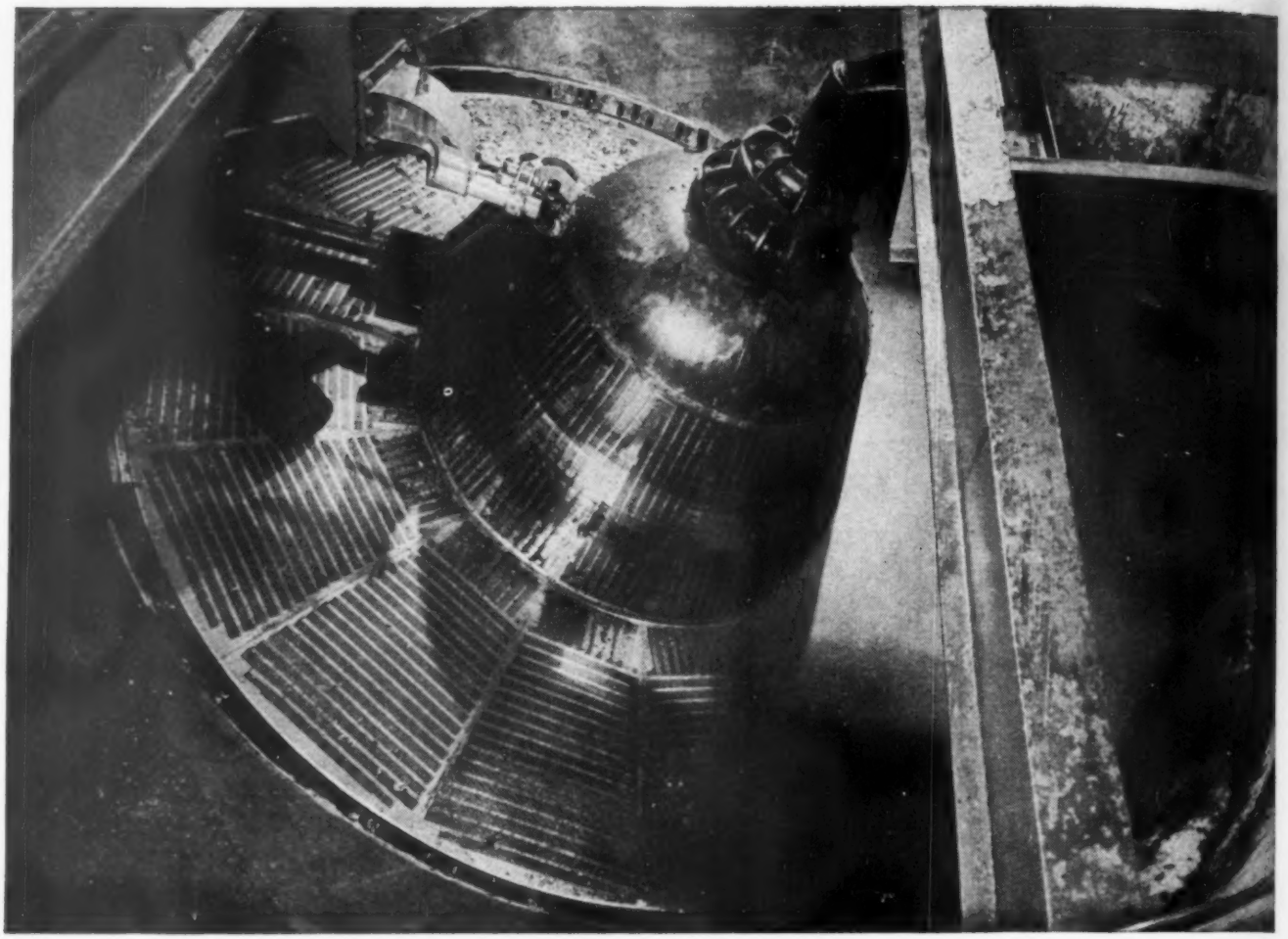


WHEEL AND TRACK-TYPE tractors, power units and motor graders are available in the *wide A-C line* of highway equipment. Auxiliaries are tampers, shovels, scrapers, rippers, bulldozers, mowers, sweepers, cranes and snow plows. Processing equipment; vibrating screens, crushers, kilns, sifters, and roller mills. A 2234

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great



New Jamaica Plant Specifies *Everdur* for Rugged Service

THIS 20-foot inclined revolving disc screen with cone and disc of slotted Everdur* plates, can handle 65 million gallons of sewage in 24 hours.

Two of these screens, designed and installed by Krajewski-Pesant Mfg. Corporation, are in service at the Jamaica Sewage Treatment Plant of the City of New York, removing solids and flocculent material to prepare sewage waters for subsequent activation.

In selecting time-tested Everdur for this rugged service, the manufacturers knew from long experience that these copper-silicon alloys possess exceptional resistance to the extremely corrosive conditions of sewage service . . . that they machine readily and may be formed, forged and welded.

It is this unusual combination of properties that dictates the use of Everdur where operating requirements are most severe. For detailed information, write for Publications E-11 and E-5.

*REG. U. S. PAT. OFF.

Where Everdur Serves in

NEW JAMAICA PLANT . . .

In four grit ejectors: Everdur for gate slides and cylinders, piston rods, valve stems, bolts and nuts.

In 5 hydraulic sluice gates: Bolts, facing strips, and other mounting parts. Also copper-silicon alloy 4¼-inch diameter operating stem.

In two inclined 20-foot diameter revolving disc screens: Slotted Everdur plates for cone and disc.

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Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

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FOR CERTAINTY IN CHEMICAL CONTROL

. . . *Rely on* B&A *Reagents*

Nowhere is chemical control more vital than in today's water and sewage plants. Upon the purity of drinking waters . . . upon the proper treatment of wastes . . . public health depends. The plant chemist working with the precision tools of his profession is the guardian of the community he serves; every test and every analysis he makes must be done with unerring accuracy.

For certainty in such responsible work, depend on B&A Reagents.

These high purity products of General Chemical Company's Baker & Adamson Division are chemical micrometers for your most exacting analyses. They are made to the decimal-point accuracy of A.C.S. standards . . . and are backed by all the specialized skills and science B&A has developed in 64 years of "setting the pace in chemical purity."

Extensive stocks of B&A Reagents are carried at the Company's *own* chain of regional warehouses from coast to coast.* Use the one nearest you to fill your reagent needs. By telling the B&A Technical Serviceman your month-to-month requirements he can plan with you in building these local stocks to supply you quickly . . . conveniently . . . whenever you call.

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If you buy or specify industrial laboratory reagents, you will find the 200-page book of B&A products an invaluable guide to 1,000 quality chemicals. *For free copy,* make request on business letterhead to nearest B&A office below.

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SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

* Complete stocks carried here.

F-M Centrifugal Pumps: Double-suction, side-suction, multi-stage, angle-flow, vertical—all types, modifications and sizes

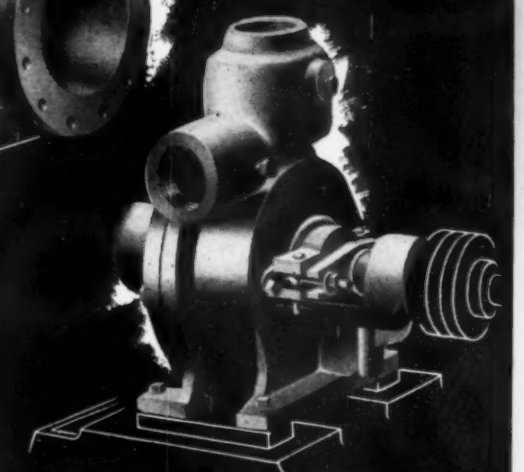
WHAT MAKES A GOOD PUMP DEALER?

A pump dealer is as good as the line he sells, and the facilities he maintains for servicing his customers' pumps.

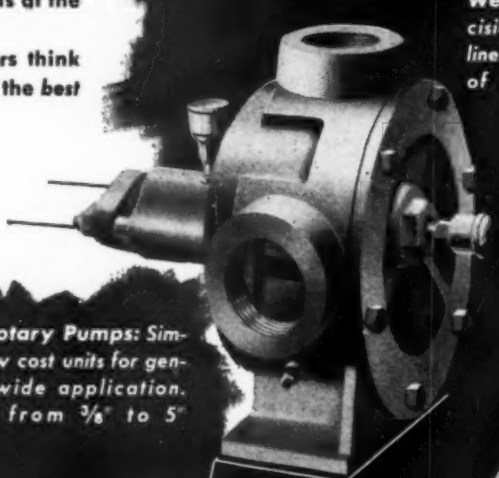
You look to a *good* dealer for a *broad* line of pumps—with so many types and sizes that he can give you unprejudiced advice . . .

You look to a *good* dealer for the benefits of a service organization that's ready and able to solve your pumping problems at the drop of a hat . . .

That's why so many pump buyers think of their Fairbanks-Morse dealers as the *best in the business.*



Westco Turbine Pumps: Precision-built, with renewable liners: for high head pumping of wide variety of liquids



F-M Rotary Pumps: Simple, low cost units for general, wide application. Sizes from ⅜" to 5"

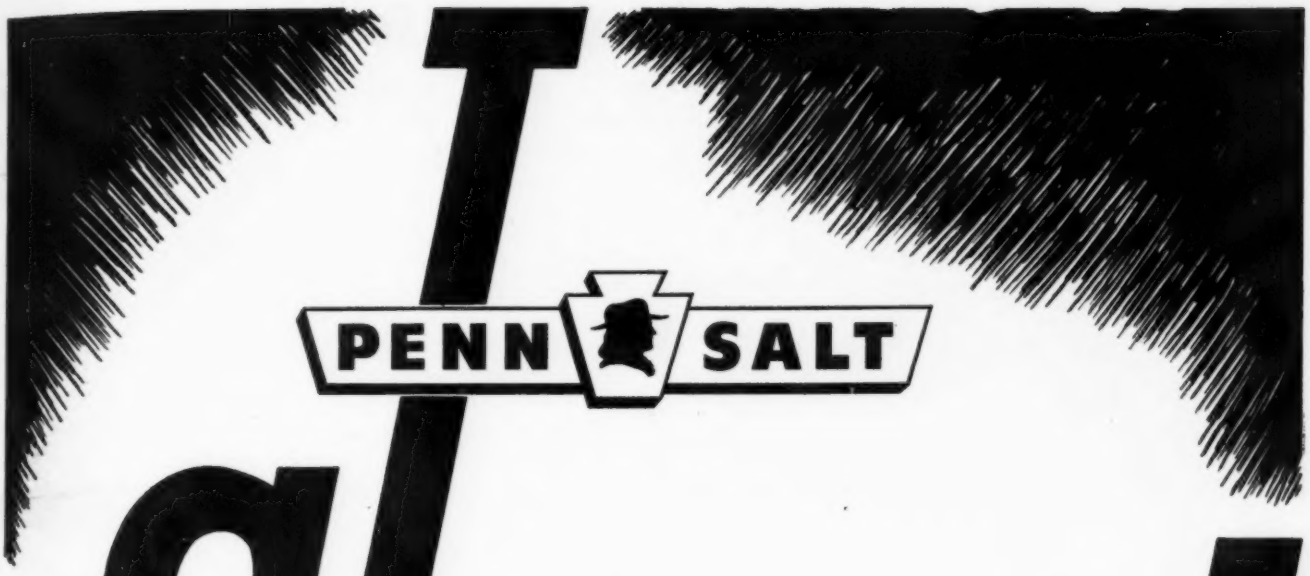
F-M Pomona Deepwell Turbines: Oil or water-lubricated: with open or closed impellers, as your job requires

F-M Propeller Pumps: For large capacity low head service

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS • STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS



PENN SALT

Liquid Chlorine

CHLORINE has come to be a "standard" chemical for water purification. In addition, under certain circumstances it tends to stabilize sludge, control taste and odors, aid precipitation, prolong disinfecting action.

Chlorine is also the most generally used agent for controlling odors of sewage. It also aids in the prevention of sewer and manhole disintegration.

Pennsalt was a pioneer in liquid chlorine production in this country, and for nearly half a century has supplied high quality chlorine to industry.

PENNSALT PRODUCTS

for Water Sanitation Treatment and Sewage Treatment: Liquid Chlorine • Perchloron* • Anhydrous Ammonia • Filter Alum • Ferric Chloride • Sodium Aluminate • Quaker Improved Chlorinated Lime • Caustic Soda.

*Reg. U. S. Pat. Off.

PENNSYLVANIA SALT MANUFACTURING COMPANY

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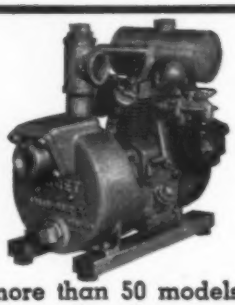
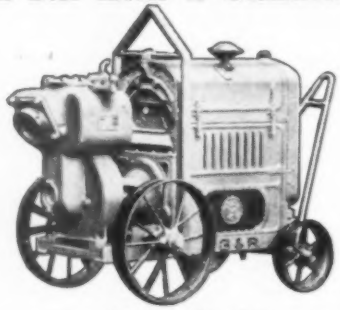
NEW SANITARY CLEANER MEETS PUBLIC HEALTH STANDARDS

THE MIDGET



Smallest of more than 50 models of Gorman-Rupp centrifugal pumps, the Midget can do hundreds of handy pumping jobs. Small, compact – weighs only 60 pounds complete – easily handled by one man. Automatic self-primed – when the motor starts, the water starts. Streamlined interior can't clog. Pumps more water for its size than any other pump on the market.

Whatever size your pumping job may be, up to 125,000 gals. per hour, your best choice is Gorman-Rupp.



Gorman-Rupp Model 1602 (90M) pump, capacity 1500 GPM at average total head.

HERE'S A GOOD BUSINESS FOR SOMEONE IN YOUR TOWN!

Public Health Officials - Show this Announcement to Sanitary Service Operators in Your Community!

The New Odorless Sanitary Cleaner is modern apparatus for cleaning septic tanks, vaults and cisterns. It is complete in every respect. It is shipped ready to mount on standard truck chassis, 158 to 161 inches length. It is built by the Gorman-Rupp Company, a leader in the pump industry.

This O. S. C. unit is approved by public health officials because it eliminates old-style, makeshift equipment – often open tanks, diaphragm hand pumps and even shovels. With an O. S. C., cleaning the septic tank is as casual and efficient as any other household service.

The O. S. C. has a powerful Gorman-Rupp Centrifugal Sewage Pump of self-priming design. Septic tanks of 500 gallon size are cleaned in 15 minutes; 1,000 gallon size in 20 minutes. A 25,000 gallon septic tank was cleaned in just 10 hours.

It's water-tight, fly-proof and entirely enclosed. A boon to operators now in business. A real opportunity for the veteran wanting his own business. Buy an O. S. C. unit under the G. I. Bill of Rights.

For further information and descriptive literature write

THE GORMAN-RUPP COMPANY

GORMAN-RUPP PUMPS — UNSURPASSED FOR PUMPING FAST

HYDRO-TITE

BETTER THAN LEAD

and available for immediate delivery

For more than thirty years water works superintendents have used Hydro-tite because it is better than lead. They have found that Hydro-tite sets immediately without shrinkage, requires no caulking, is self-sealing and costs less. For more than thirty years Hydro-tite has given unqualified satisfaction. Time has proved that Hydro-tite joints are strong, flexible, tight and enduring.

Today, Hydro-tite is more in demand than ever before. It is available for immediate delivery from strategically located warehouses; and at prevailing prices. The cost is only about ¼ as much as that of lead.

Send for data book and sample.

ALWAYS USE FIBREX

Fibrex is a paper packing treated with a special disinfectant and water repellent which keeps the fibrex sterile and prevents disintegration. Fibrex is used exactly the same as braided jute. The cost is about 30% less. Send for sample.

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Main Sales Office: 50 Church St., New York, N.Y.
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STOCKS AVAILABLE FOR IMMEDIATE SHIPMENT FROM

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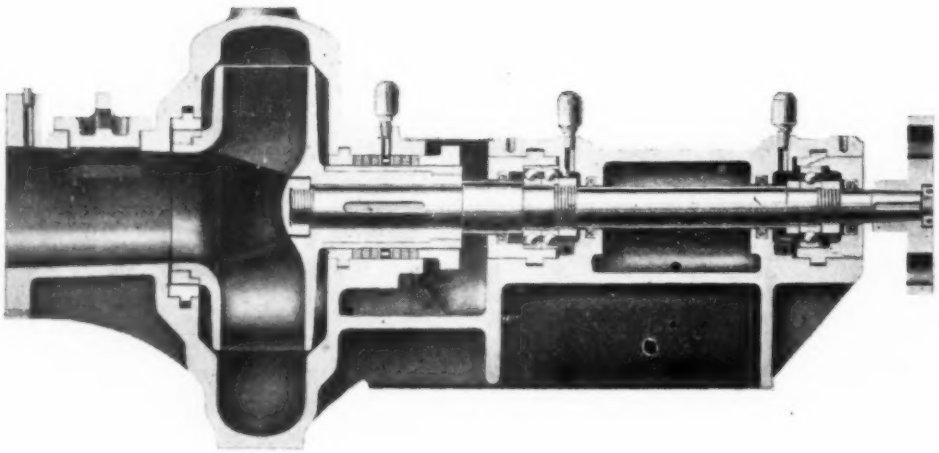
DE LAVAL
the
QUALITY
pump
in the Sewage Field



In order to withstand the severe service imposed upon a pump handling gritty, trash-filled water, De Laval Sewage Pumps are designed with the same engineering skill and manufactured to the same high standards as are the famous De Laval Water Works Pumps.

The casing of the De Laval clogless sewage pump is split on a plane with the axis to allow the cover to be lifted without disturbing piping connections. All parts are easily replaceable, including the shaft sleeve and also the renewable wearing rings at the running joint between impeller and casings. When wear occurs at the latter point, resulting in leakage from discharge to suction, efficiency can be easily restored by the installation of new rings.

Send for literature describing these and other quality features of the De Laval Clogless Sewage Pump.

CP-1

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TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

OUT IN FRONT

INSURES PALATABLE AQUA NUCHAR DRINKING WATER

In recent years, the use of activated carbon for water purification has become standard practice and has been used by progressive waterworks superintendents in more than 1200 communities.

Aqua Nuchar Activated Carbon, because of its microscopic fineness, has amazing ability to remove by adsorption the tastes and odors that affect your water supply. The extraordinary porosity of Aqua Nuchar not only results in greater adsorption because of the larger surface area exposed, but also accounts for its superior properties of dispersion and suspendability. This all adds up to more palatable water at a very inconsequential per capita cost.

Aqua Nuchar Activated Carbon has been demonstrated conclusively to be the most effective, economical method of eliminating tastes and odors from water supplies. Check your Aqua Nuchar stocks today and be prepared for any change that may arise in your raw water supply.

INSURES PALATABLE AQUA NUCHAR DRINKING WATER

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

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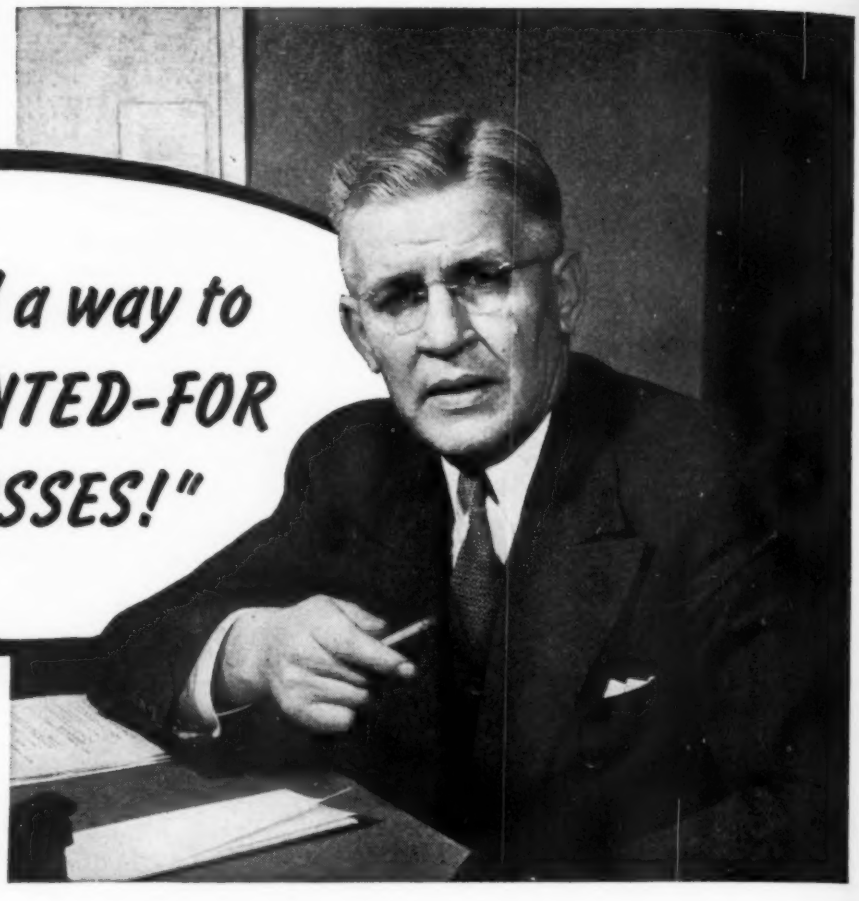
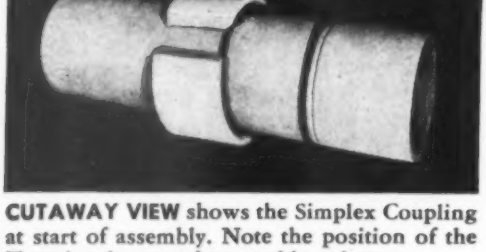
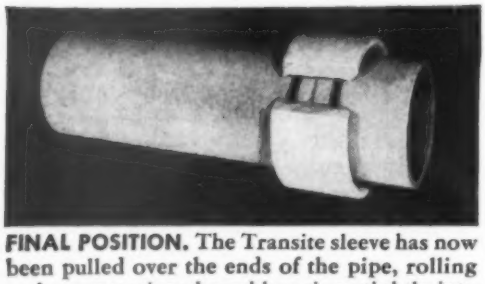


Water Works men find Transite's Simplex Couplings guard against joint leakage.



CUTAWAY VIEW shows the Simplex Coupling at start of assembly. Note the position of the Transite sleeve and two rubber rings.



FINAL POSITION. The Transite sleeve has now been pulled over the ends of the pipe, rolling and compressing the rubber rings tightly into position.

"Water pumped but not paid for" is a hidden item in the books of many municipal water departments. A considerable part of this loss can often be traced to underground leakage—a loss which Transite Pipe has helped to reduce in hundreds of cities and towns.

An important reason for this is Transite's Simplex Coupling. Engineered to combine tightness with an unusual degree of flexibility, this coupling cushions the line against vibration, helps compensate for soil movement and earth stresses. Thus, it provides an effective safeguard against leakage at the joints.

Moreover, the Simplex Coupling is, in effect, a factory-made joint which is simply *assembled* on the job. Perfect joints are quickly, easily made, even by inexperienced crews. And each joint can be checked for proper assembly as the pipe is laid—additional insurance against joint troubles due to faulty workmanship in the trench.

Let us send you more information about the many advantages of Transite Pipe. Just write Johns-Manville, Box 290, New York 16, N. Y., and ask for the Transite Pressure Pipe brochure.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

Transite Pressure Pipe

An Asbestos Product

BYERS WROUGHT IRON

If you are considering the increased use of welding in installing or replacing piping, you'll find wrought iron an ideal material to work with. It is unusually easy to weld, and any good welder can produce uniformly excellent results.

Since wrought iron differs both chemically and physically from other ferrous materials, proper procedure is important . . . but getting first-class results is merely a matter of modification, and does not involve any new methods.

In general, the main thing to remember is that wrought iron is a two-component material, and that the silicate slag melts first. The melting of the slag should not be mistaken for the fusion of the base metal; heating should be continued until the iron fuses. Only a minimum of base metal should be melted. Welding should proceed slowly enough to allow slag to float out of weld. Unnecessary rubbing or agitation of the molten metal should be avoided. Obviously, none of these things call for any revolutionary changes. As a matter of fact, most of these precautions are observed by good welders, no matter what the material.

In oxy-acetylene welding, almost any high-quality, low-carbon rod can be used. A neutral flame will give the best results.

In metallic arc welding, coated rods are generally preferable. The large number of special-purpose rods available make it difficult to give any general recommendations, but our Engineering Service Department will be glad to suggest suitable rods, if you will state the nature of the need.

Welding fittings of wrought iron are made by well-known manufacturers, in a complete range of sizes.

Our bulletin, "The Welding and Flame Cutting of Wrought Iron," just revised, gives complete and up-to-date information on all phases of welding. If you would like complimentary copies for yourself, or for individuals in your shop, just write.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

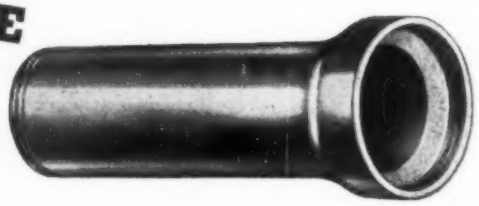
for

LONG TIME ECONOMY IN SEWAGE AND WASTE DISPOSAL

HERE

USE

DEPENDABLE ALL-PURPOSE CLAY PIPE



BECAUSE IT NEVER WEARS OUT

Far-sighted sanitary experts rely on Clay Pipe, because it contributes so much to the permanence and long-time economy of structures. Clay Pipe in today's plans will eliminate future "headaches." Clay Pipe is chemical-proof and abrasion-proof. It can be depended on to do its job year after year without crumbling, corroding or rusting. Ageless service, without replacements or maintenance caused by product failure, makes Clay Pipe the best there is for carrying sewage and industrial wastes.

A Modern Planning Tip: The many advantages of Extra Strength Clay Pipe are making it an "every day" material on large and small jobs. It is the new pipe for extra-heavy live or dead loads. On many jobs it eliminates the need for cradling or casement.

CLAY PIPE NEVER WEARS OUT!

For information about Clay Pipe, write to:

NATIONAL CLAY PIPE MANUFACTURERS, INC.
111 W. Washington St., Chicago 2, Ill.
522 First National Bank Bldg., Atlanta 3, Ga.
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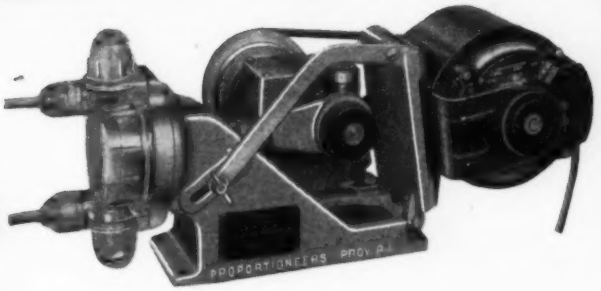
C-1146-48

CLAY PIPE

AT LAST!



MR. WATERWORKS SUPERINTENDENT:

At last you can carry out that water treating program and eliminate the dangers of water-borne disease. %Proportioneers% "Little Red Pump" is now available from stock . . . it can be supplied promptly by the factory or by our representative near you. This simple diaphragm pump will accurately proportion a chemical solution at any constant rate of feed up to 7½ g.p.h. against line pressures to 85 p.s.i. Capacity is easily adjusted by varying the stroke length setting and shifting the V-belt on step pulley to change the stroking rate. The "Little Red Pump" handles all water treating chemicals . . . inert plastic and neoprene or natural rubber are the only materials in contact with the chemical solution.

WRITE FOR BULLETIN HDM-2
or have our representative call at your plant.

% PROPORTIONEERS, INC. %

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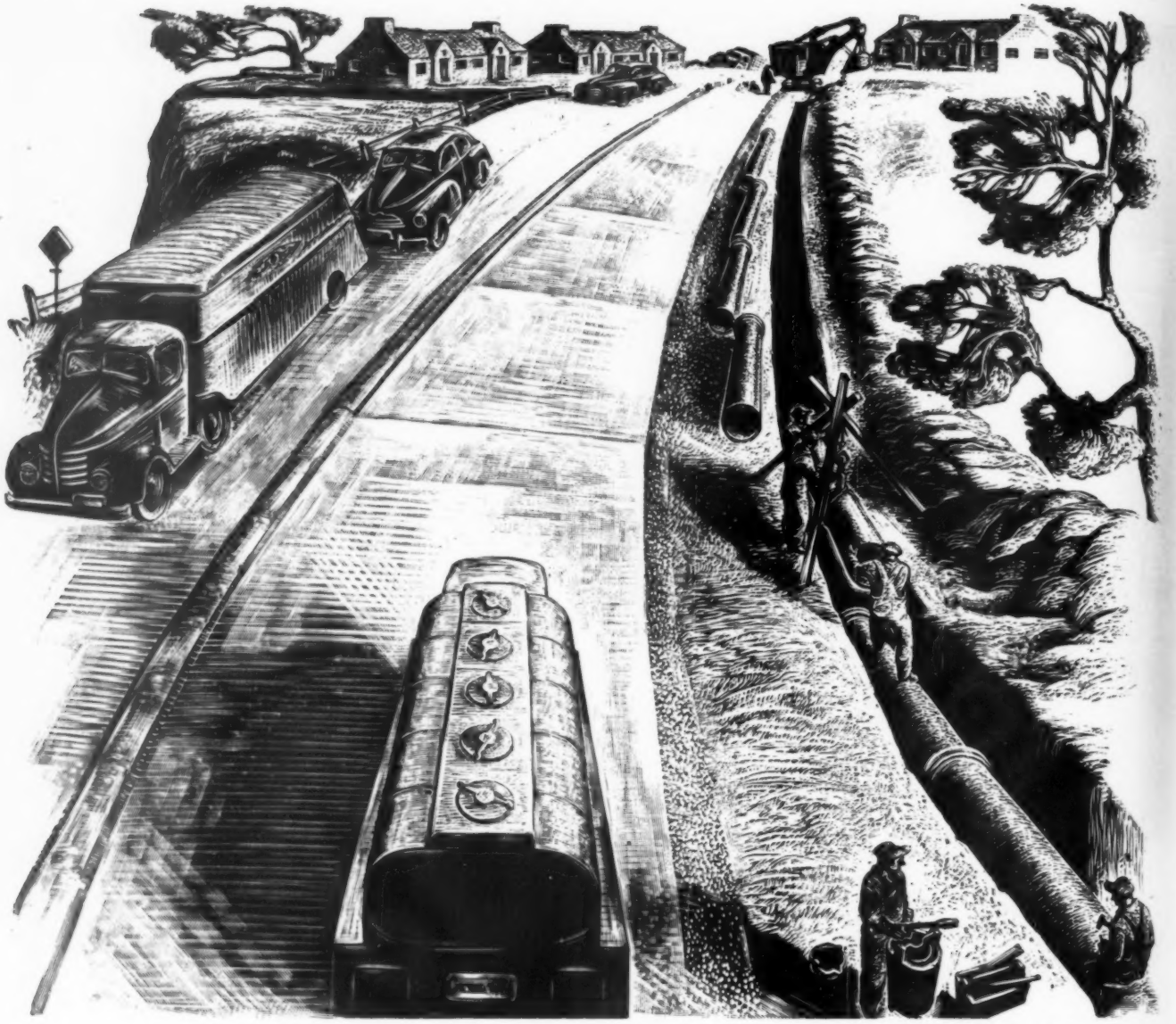

Original Woodcut by Lynd Ward

When authorizing extensions, utilities must often take the long view in estimating possible revenue. How logical, therefore, to specify long-lived U. S. Cast Iron Pipe for extensions to water, gas or sewerage lines. Cast iron mains not only serve for centuries but they serve at minimum annual maintenance cost—a statement you do not have to take on faith—a statement proved by performance records over many years throughout the world.

U.S. cast iron PIPE

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
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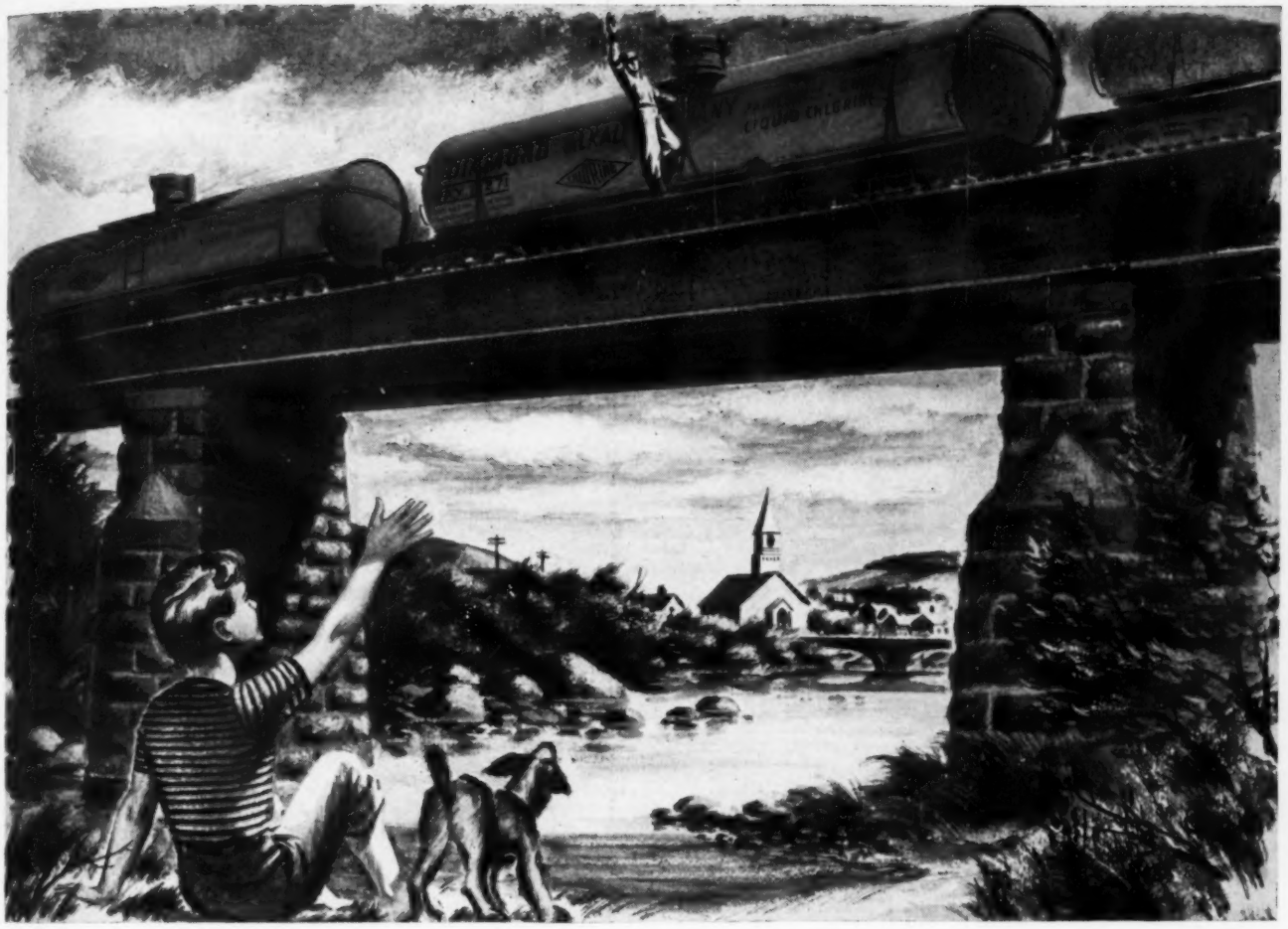
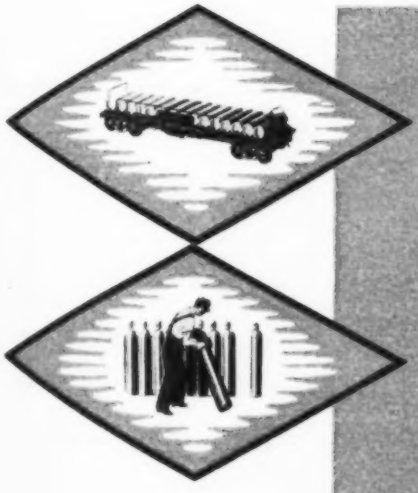


DIAMOND *Liquid* CHLORINE

Shipped to you in tank cars,



multi-unit cars, or in

cylinders, to best suit

your requirements

DIAMOND ALKALI COMPANY

PITTSBURGH 22, PA., *and Everywhere*

CHLORINE

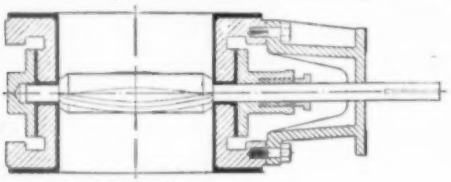
R-S valvEvents

ISSUED PERIODICALLY BY R-S PRODUCTS CORPORATION, PHILADELPHIA 44, PA., FOR THOSE CONCERNED WITH FLOW CONTROL AND SHUT-OFF

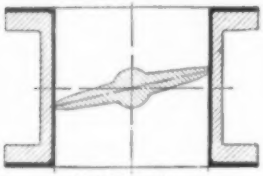
R-S Rubber Lined Valve for Corrosion Resistance and Economy

The rubber-lined valve is not to be confused with the R-S rubber-seated valve which we have mentioned in these columns.

The rubber-lined valve is a special application for anti-abrasion and anti-corrosive service. Here we have rubber, as you will see from the drawings, completely enclosing the entire body of the valve. The lining extends along the shaft and offers full protection for the stuffing-box. With this type of construction, it is possible to use an iron valve body in service that would normally call for Stainless Steel. The saving in cost is easily calculated at 60¢ to 65¢ per pound. Moreover, machining of iron is far less expensive.



Front Elevation



Side Elevation
Note angular closing disc

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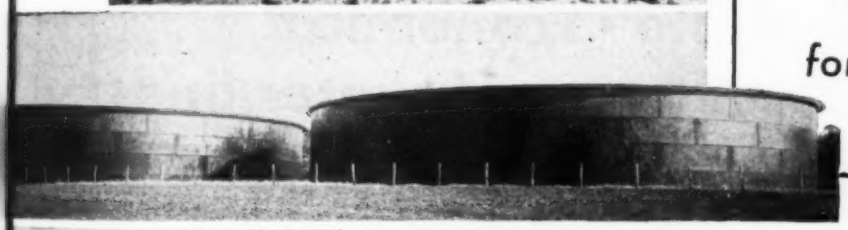

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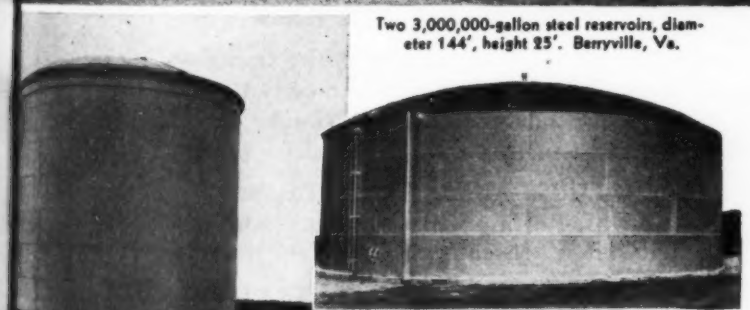

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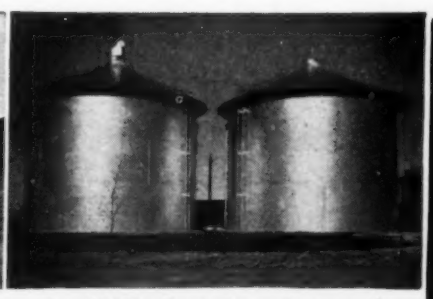

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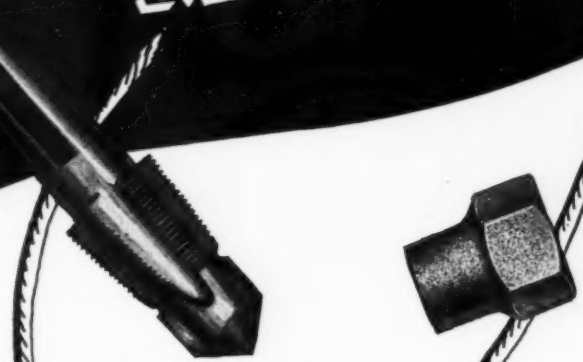

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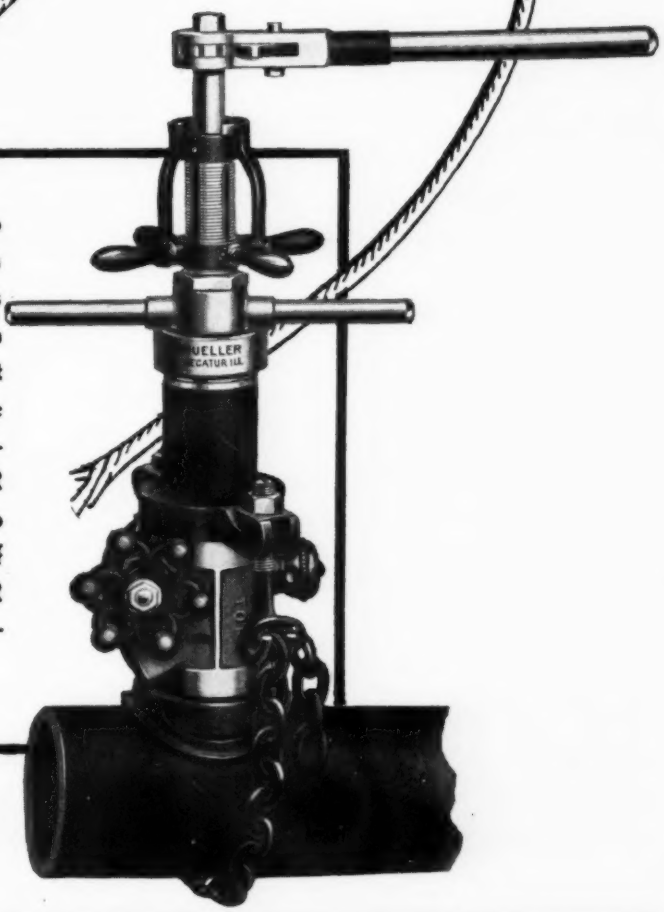

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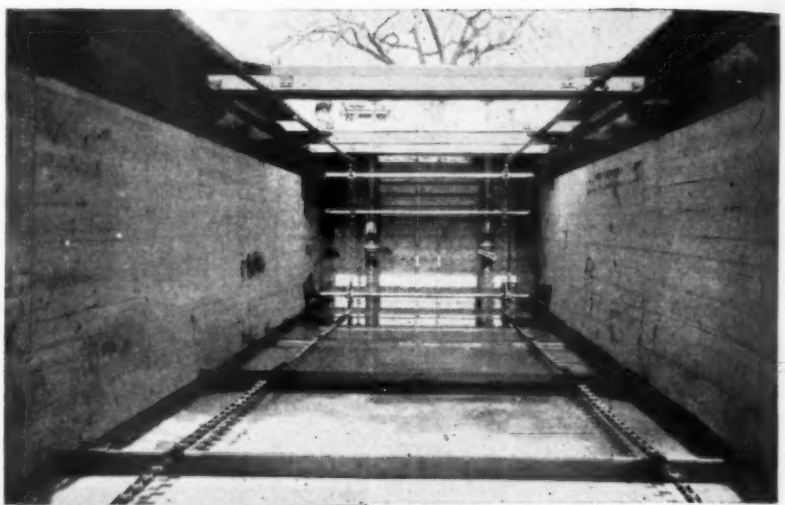

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The ABC's of Depreciation
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JOHN H. MURDOCH, Attorney,
Am. Water Wks. & Elec. Co., New York.

[Ed. Note: Because of the length of Mr. Murdoch's valuable paper we have so far been unable to print it. However, readers must not assume that it will not appear before the paper has suffered too great depreciation in itself.]

A Study of Costs of Making Water Main Extensions
Reveals some highly interesting facts on costs of making water main extensions over the past year or so. A comparison between letting main extensions to contract, as against the making of such extensions by the water utility force and employment of modern pipe handling, trenching, loading and backfilling machines is revealing. The evidence is clear enough to influence the cost conscious author to conclude that it is evident that future water works extensions must be made with modern machinery. This evidence comes from—
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FRANK L. FLOOD, Consulting Engr., Boston and EUGENE L. BOND, Supt. & Engr., Greenfield, Mass.

Handling Chlorine Safely
Is an article which contains justified repetition of certain important aspects of the transportation, storage and handling of liquid chlorine containers and the feeding of chlorine gas. In addition the authors introduce some new considerations and suggestions looking toward the safest possible methods of handling chlorine in water and sewage plants. This worthy article is a joint contribution by— MESSRS. LOGAN, CLARK and GAUDIN, of The Mathieson Alkali Works.

Hydraulics for the Practical Water Works Man
is a continuing series of articles by Prof. R. W. Angus of Toronto, for many years a teacher of hydraulics and consulting engineer. The next of the series—"Venturi and Other Differential Type Flow Measuring Units"—will appear in June.

With Regrets!
The report of the interesting 27th annual meeting of the **Canadian Section of A.W.W.A.** prepared for this issue must be held over for our June issue because of the continued tightness of paper supply and to avoid curtailment of the report to a hurtful degree.

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WATER & SEWAGE WORKS

VOL. 94, NO. 5 MAY, 1947

A Gillette Publication

SOMETHING NEW IN WATER RATES

By MELVIN P. HATCHER*
Director
WATER DEPARTMENT
KANSAS CITY, MO.

SO THAT the scope of the article to follow may be anticipated, it should be said now that it will not embrace a discussion of the whole field of rates for water works properties. Rather, it will deal with rates for service to residential, commercial and industrial consumers and particularly with conclusions drawn out of studies by the author which are believed to shed some new light on the industry's rate practices.

Nearly all water works properties make use of rates for service to general customers that include either one of two devices — the "service charge" or the "minimum charge"—designed to insure reimbursement to the water utility for certain expenditures made on the customer's account whether any water is used or not. These expenditures are generally understood to include the cost of meter reading, billing, collecting and meter repair and fixed charges on meters and services, although there are those who will contend that the service charge should be made to cover fixed charges on all property entailed in providing service to the customer. A few water works properties make use of both the service charge and the minimum charge in one set of rates but as far as the author knows they have not used these charges in the way that is proposed in this article.

The author had occasion ten years ago to study the feasibility of a combination of the service charge and minimum charge in one set of rates to accomplish a particular purpose and has come to believe in recent years in connection with the study of rates for the Kansas City system that there is merit in the idea of a minimum rate for the residential and small commercial group, which comprises 95% of the total number of consumers served by most water systems, and a service charge for the industrial consumers. The idea encounters some difficulty with the rules needed to govern the applicability of the rate in the consumption range between the upper limits of normal residential consumption and the lower limits of industrial consumption but it does appear that these difficulties can be overcome in an equitable and workable way.

The Author

Why Should Precedent or Expediency Continue to Dictate?

Explorations into this matter of rates by classes of consumers brought one more idea to light that is believed to be somewhat in advance of present day conceptions of water works rate practices. The great uncertainty of present practices is centered in the treatment of fixed charges on property. The service charge as now conceived provides for a distribution of less than about 5% to 10% of these total fixed charges. The remainder is distributed over the commodity portion of the rate in ways that are governed mainly by precedent or rule-of-thumb and for reasons that have never been thoroughly explained or accepted. It becomes apparent in any study of rates by classes of consumers that a proper determination of the respective costs of service requires an apportionment of the fixed charges on property and that this apportionment must rest on the relative demands of these classes of consumers on the supply works and distribution system. Most water works operators are undoubtedly aware of the load factor differences between the residential and industrial groups of customers, although these differences are likely to be of greater consequence in some parts of the country than in others. However, the author does not recall its having been said anywhere in water works literature that these differences are the real explanation of the practice of loading a high percentage of property fixed charges on the first 25,000 gallons or so of water used per month. The residential customer's higher ratio of peak demand to average demand in most localities does seem to explain most of the main price differential in rates and it does appear that the whole perspective regarding water rates could be improved by a better understanding of load characteristics of consumers by classes.

*The author gratefully acknowledges his indebtedness to W. Victor Weir, President, Missouri Water Co., and Russell G. Kincaid of Burns & McDonnell Engineering Co. for very helpful comment and criticism developing from their respective reviews of the original manuscript for this article.—M.P.H.

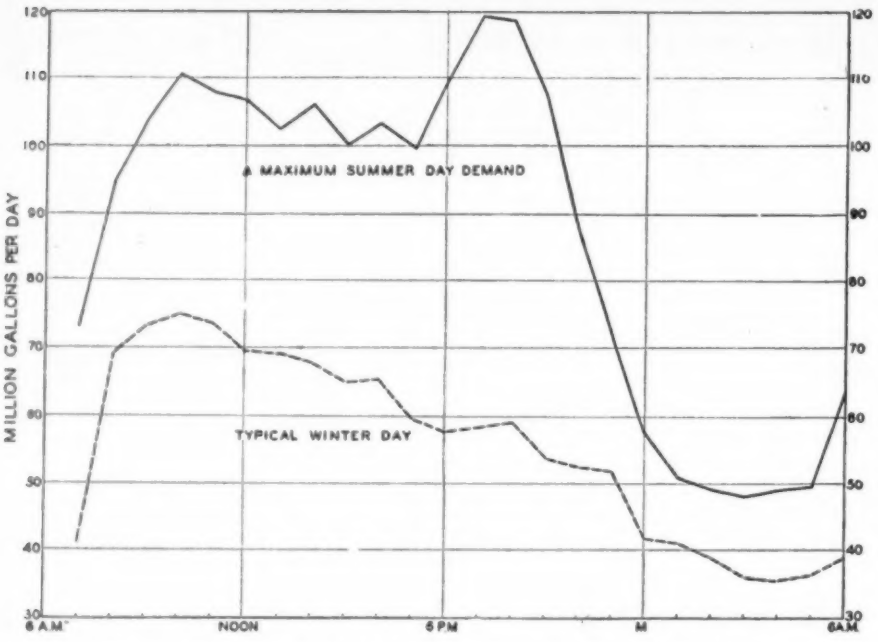


Fig. 1. Hourly Variation in Water Demand—Kansas City, Mo.

Much of the best that has been said regarding water works rate practices is included in reports of committees on rates presented to the New England Water Works Association and the American Water Works Association in 1916 and 1923 respectively and in the book "Meter Rates for Water Works", published in 1918 and authored by Allen Hazen who was chairman of each of the committees just mentioned. The two committee reports arrived mainly at the definition of a proper rate structure giving only limited attention to problems involved in the mechanics of rate making and they arrived at conclusions that were practically identical in scope and substance. Mr. Hazen's book apparently reflects the deliberations of the first committee in that its rate making plan is built around the rate form recommended by the Committee. The book goes very thoroughly into the theory and practice of rate making and explains by example the whole mechanics of rate analysis. It remains today the best single reference on the subject.

The two committees concluded that water works rates should be made up of a service charge varied with the size of the meter, plus a commodity charge in block form arranged in three blocks as follows and with these quantities per block:

For the first 25,000 gallons per month .... per 1000 gallons.

For the next 225,000 gallons per month .... per 1000 gallons.

For all over 250,000 gallons per month .... per 1000 gallons.

[A fourth block for consumption in excess of 2½ million gallons per month was proposed for systems supplying customers needing more than this amount of water. The quantities given here anticipate monthly billing and meterage in gallons. The quantities per block and the unit of measurement must be stated to suit the billing period and the basis of meter measurement. Thus, the first step would be 75,000 gallons or 10,000 cubic feet per quarter.]

The reports concluded that the service charge should include the cost of meter reading, billing and collecting, meter repair and fixed charges on the meter and the service. They observed that the practice of loading the service charge with each customer's share of fixed charges on the remainder of the property caused an approach to the condition created by flat rates, thereby resulting in the loss of some of the advantages of metering. The committees also recommended against the practice of disguising the service charge in a charge for a small amount of water on the ground that such use was subterfuge and should be discouraged.

The rate making plan in Mr. Hazen's book follows the recommendations of the two industry association committees. The essence of the plan is that the costs described above are distributed via the service charge, and the fixed charges for the remainder of the property are distributed over the commodity portion of the rate in such way as to cause the rate for the first block to exceed the rate for the third block or tail rate by a ratio of not more than 2 to 1.

Despite these blessings from the industry, however old and neglected they may be, the service charge has gained little momentum in water works rate practice. In a survey* involving the rates for 393 cities having populations of 10,000 or more, the service charge and the minimum charge were found to have been made a part of rates in the following percentages of cases:

Minimum Charge	78%
Service Charge	12%
Combination Minimum and Service Charge	8%
Neither	2%

The failure of the industry to make more use of the service charge is undoubtedly due to customer prejudice against this charge. Either for want of understanding or because of an unwillingness to admit the fairness of the principle involved, many customers do object to the charge.

Argument for the Service Charge

There are, however, certain reasons for the use of the service charge that may not have had the emphasis they deserve and these reasons apply mainly to the service of customers using large meters. This suggests the possibility of a compromise that makes use of the fact that only a small percentage of customers use large meters and that these customers are likely to include those easiest to sell on the service charge idea because of their better understanding of the principle involved and the likelihood that they have become acquainted with a similar feature in their electric utility rates.

One good reason for the service charge on large meters is that its use would discourage meter oversizing. This in turn would tend to reduce the amounts of revenue lost because of under-registration at low flows. The plan will cause a more equitable distribution of fixed charges on meters and services. The service charge should cause some customers needing heavy drafts of water for short periods to depend more on storage on the property and less on meter and service size, thereby reducing the difficulty. This applies especially in small systems which more prevalently experience heavy pressure draw downs in the distribution system. The service charge will tend to discourage multiple metering. There are more disadvantages to the latter condition than the mere task of reading and servicing

*Water Rate Structures in American Cities—Public Service Commission of Wisconsin, 1940.

more meters. More than one meter to an industry adds to the likelihood that faulty meters will go undetected for longer periods.

ADVOCATING A COMBINATION MINIMUM AND SERVICE CHARGE

The author therefore proposes a rate plan that makes use of the minimum charge varying with meter size for residential and small commercial consumers and a service charge varying with meter size for industrial consumers. The advocated plan will require a rate comprised of two parts, one part being a commodity rate accompanied by minimum charge provisions for the first group, the other part being a commodity rate plus a service charge for the second group. Actually, the two rates will be tied together in the applicability rules in the sense that most customers apparently should be permitted to choose one or the other rate. However, the rate plan will be worked out in a way that will cause the commercial or industrial rate to be almost without effect below consumptions of about 30,000 to 35,000 gallons per month and will cause the residential rate to be without effect above these consumptions, except that it appears now on the basis of present information that single and double family residences should be required to pay for service under the residential rate regardless of their consumption or meter size. More specific information regarding the arrangement and application of the rate is given later following a discussion of some more of the reasoning in support of the plan.

To restate the two main points in favor of the combination rate plan they are these: (1) The plan will provide for better control of large meter sizes and (2) the plan will bring about a grouping of consumers that will lend itself to a distribution of property costs that recognizes the poorer load factor imposed by residential consumers as a class compared to that imposed by industrial consumers.

It does not appear that this rate plan will bring about a distribution of costs that will actually vary much if any with that resulting from rate plans now in use. The plan will, however, provide what appears to be the real explanation of the practice of pricing the first 25,000 gallons or so of water metered per month at two or more times the tail rate. The Water Rate Committee of the American Water Works Association, referred to previously, made the observation that the main justification for this spread was the greater investment in mains serving small consumers and in services and meters and in the additional cost of meter reading and billing. In the author's opinion, this misses the main point. The real justification must lie more in *load factor* differences between the residential and industrial groups. Present rate practices seemingly have been developed not so much from a measure of the principle involved as from expediency and demonstrations through the years that rates proportioned in this way seemed to serve best.

Consideration of the Load Factor Principle

A further explanation of the difference in load factor for residential and industrial consumption will throw more light on the reason for the distinction in rates for these two classes of consumers. The demands which the parts of a water works system are required to meet are the criteria which fix the capacities of these parts and it is proper therefore that they be made the basis for property apportionments in a rate analysis. The capacities of supply works and purification plants are generally gauged by maximum daily demands for the reason that hourly fluctuations in demand are generally ironed out by provisions for storage of water after purification or on the distribution system. Pumping plants and distribution systems must meet maximum hourly demands although, here again, storage may tend to equalize hourly demands. The contributions made to the maximum hourly or maximum daily demands by the residential-small commercial consumers as a group, and by industrial consumers as a group, do not bear the same percentage relationship to each other as do their respective

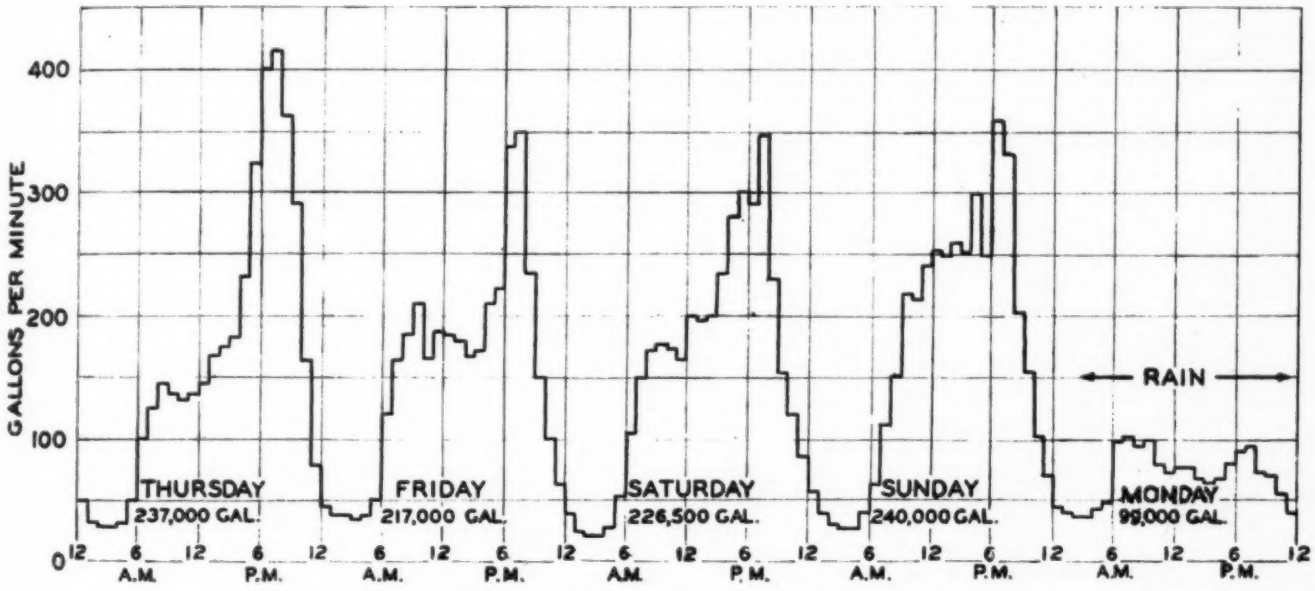


Fig. 2. Peak Hourly Demands of 600 Kansas City Residential Consumers
(Note high Sunday demand due to lawn sprinking in comparison to Monday when the rains terminated an intense drought period.)

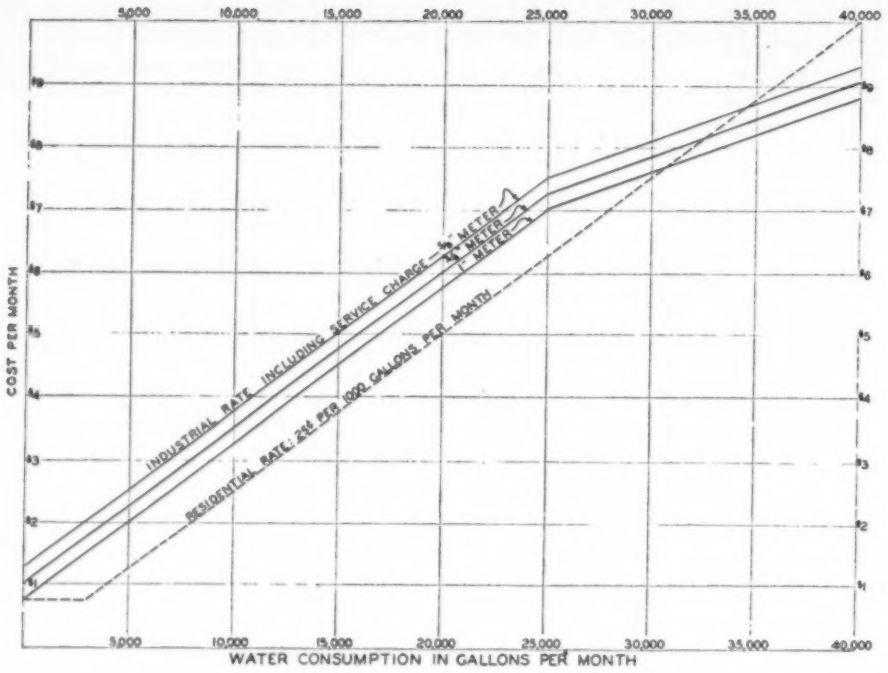


Fig. 3. Comparison of Costs Under Residential and Industrial Rates

quantities of water consumed. In other words, when defining load factor as the ratio of average demand for a year to the demand at the time of the system peak demand, the load factor for the residential-small commercial group is likely to be quite at variance with the load factor reflected in industrial consumption. Therefore, it is not proper for fixed charges on property to be distributed wholly on the basis of the total quantity of water consumed in a meter reading period, but rather the variations in load factor must be taken into account if the rates are to be made to effect a proper distribution of costs.

Taking this load factor variation into account will cause the residential group to be charged with more property costs per unit of water consumed than is charged to the industrial group. This should not lead to results much in conflict with present practices or with the conclusions reached by the industry committees referred to above or by Mr. Hazen or by other writers, unless it should develop from more careful studies of peak loads in individual cases that residential consumers deserve to carry even more of these costs than are reflected in present practice. It does not appear that their burden will be reduced by the separate consideration proposed here.

The reasons for the variations in load factor and the distinction in rates between the two groups of customers is fairly apparent. Systems supporting a lawn sprinkling load of any consequence are most likely to have a system daily peak load during the sprinkling season and the daily load curve is likely to have its hour of peak demand between the hours of 5 p. m. and 8 p. m. which is the time that home owners usually devote to lawn tending in the summer months. Industrial consumption is generally an 8 a. m. to 5 p. m. load although of course this will not be true for quite a few of the consumers that will be classed with this group on account of their consumption. It will be true enough, however, unless the industrial consumers on the system predominate enough to create their own daily and hourly peak demands.

Specific evidence of the participation of either group in the peak loads of a particular system may not be readily available unless its need has been anticipated and data has been collected especially for the purpose during periods of peak demand. It seems desirable that water works operators should give some thought to this need if there is the merest chance that existing water rates may be revised or changed. In this connection the operating records of water works properties will include certain pertinent information that can be brought to bear on the problem. Distribution system load studies or similar data helpful to the analysis of system peak loads may be available and there is some published information pointing the direction to a solution of the problem. Kincaid in his articles on "Analyzing Distribution Systems" *Water Works Engineering,* March 22, 1944) reported on studies of two parts of a distribution system at Omaha, Neb., one serving an area predominantly residential in character, the other serving an industrial area. Those studies revealed the following rather wide variations in demand, expressed in terms of percentage of average yearly demand:

	Residential Area	Industrial Area
Maximum day	251%	168%
Maximum hour	560%	244%

Kansas City's Practice and Observations

For meter reading, billing, collection and for statistical purposes, Kansas City divides its general customers into two classes, based on consumption. Consumers using less than 5000 cubic feet or 37,500 gallons per month are placed in one group. This group includes all single and double family residences and is therefore essentially residential in character. It accounts for about 96% of the total number of consumers. The meters for this group are read bi-monthly. All other consumers fall in the second group, and their meters are read monthly. It is not quite but very nearly true that the 1 inch meter is the largest meter used by consumers in the first group.

As a step in the review of Kansas City's rate plan, the author made it a point to study the contribution of each of these groups to the system's peak hourly demands, the purpose being to effect an apportionment of the property costs related to that demand. The subdivision was based on studies of hourly and daily demands of selected groups of consumers, on data developed in a Hardy Cross analysis of the distribution system and on certain load factor assumptions. While the supporting data was not as extensive and conclusive as might in time be sought for, there was enough evidence to show that the approach was in the right direction and that the application of the subdivision to the property affected did produce results that were in keeping with present rates, and these rates have served and are serving rather satisfactorily as far as the apportionment of costs to these two groups of customers is concerned.

The trend of Kansas City's

hourly demand during a day of maximum demand is shown in Figure 1 in further explanation of this point. The subdivision of maximum hourly demand was based on the calculation of hourly demand for the residential group of customers at 400% of average demand for the year, as evidenced by customer meter registrations and the use of 200% of average for the industrial consumers. These load factor assumptions appear reasonable in light of specific data reported below and in light of the rule-of-thumb that has grown out of experience with the demands of the better grade residential areas in and around Kansas City. By this rule, the maximum day is taken as 250% of the average day and the maximum hour is taken as 200% of the maximum day. This results in a 500% relationship of maximum hour to average hour for the year as compared to 400% used in the Kansas City calculation referred to above.

Water consumption by Kansas City home owners was affected last summer by one of the worst drouth periods of recent years. Only about one inch of rain fell between July 1st and August 10th and maximum daily temperatures exceeded 90° for three-fourths of this time. Near the end of this period the hourly rate of demand for water reached an all-time high of about 125 million gallons per day. During this drouth period and near the days of maximum system demand, flow tests were made to determine the hourly variation in the demands of several groups of customers made up almost entirely of home owners. The ratios of maximum hourly and maximum daily demands to average demands for the

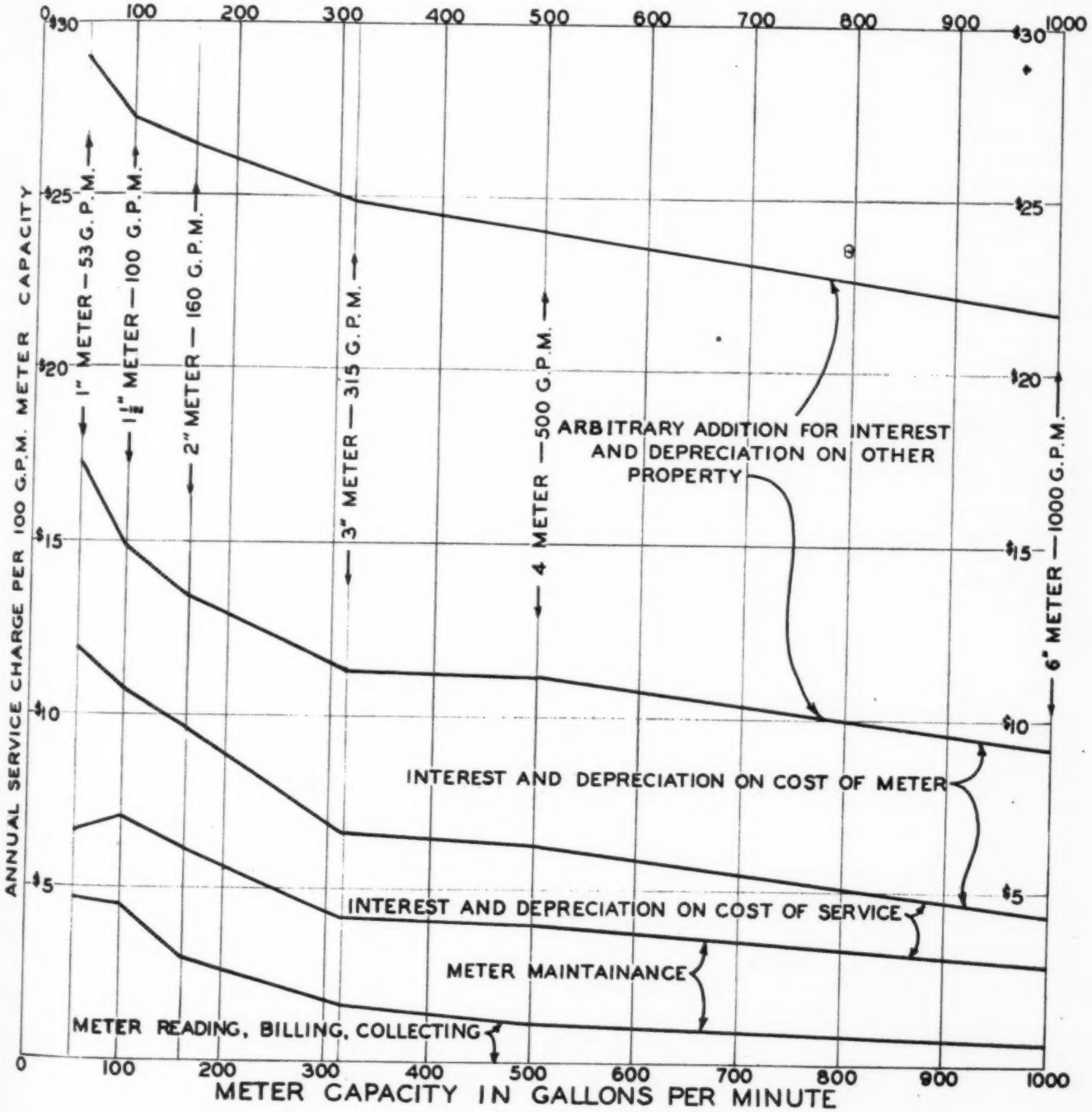


Fig. 4. Component Parts of Service Charges Based on Meter Capacities

(Note—⅝ in. and ¾ in. meters not included, since only a minor number of customers served under the industrial rates will have these small meters.)

year for two of these groups are shown in the following tabulation:

	Group I	Group II
Number of consumers.....	70	600
Average consumption, (g. p.d. per consumer).....	229	178
Ratio, max. hour to avg. hour	673%	560%
Ratio, max. day to avg. day	305%	222%

The pattern of the above daily demands for one of these groups is shown in Figure 2, and the above tabulated ratios, it should be observed, were encountered at a time when the peak hourly demand of the whole system measured about 210 per cent of yearly average total deliveries to the system and the maximum day for the system measured about 155 per cent of the average day. It is evident from a comparison of these system ratios with those tabulated above for residential consumption (also from Fig. 2) that the residential class of service has a much poorer load factor than does the service to the industrial class of consumers.

What the Load Factor Will Do to Rates

It appears that a proper recognition of this load factor difference will cause residential consumers to be charged with a percentage of property costs that is greater than their share of water used and that this property apportionment will cause this group to be charged for water at a rate that is 2½ or 3 times the tail rate and it *may* develop from a thorough study of these factors that the ratio should be even higher.

This point is illustrated in a sample calculation in Table I.

Table I
PROPERTY APPORTIONMENT

(a) Supply Works	Metered Water	Delivered Water	Average Day	Factor	Maximum Day	Portion
Residential	1272 mg	1540 mg	4.22 mgd	170%	7.20 mgd	62.6%
Industrial	995 mg	1210 mg	3.31 mgd	130%	4.30 mgd	37.4%
Totals	2267 mg	2750 mg	7.53 mgd		11.50 mgd	100.0%
(b) Distribution System						
Residential	1272 mg	1540 mg	4.22 mgd	300%	12.66 mgd	65.8%
Industrial	995 mg	1210 mg	3.31 mgd	200%	6.62 mgd	34.2%
Totals	2267 mg	2750 mg	7.53 mgd		19.28 mgd	100.0%

Note that the residential consumers use 56 per cent of the water but that they are charged with 62.6 per cent and 65.8 per cent of main portions of the property on the basis of variations in load factor that are not as extreme as could be contended for on the basis of the evidence now available in Kansas City's case, for instance.

Before proceeding with more of the discussion of property apportionment to general consumers, the observation should be made at this point that peak load analysis may not be the answer to all parts of a rate problem. The water works industry does not have quite as good an example of individual loads not being coincident with system peak loads as does the electric utility industry, but it does have one class of service somewhat in that category. In the electric utility industry, street lighting most often comes as an off-peak load. It would hardly be logical in that case, however, to charge street lighting with no part of the fixed charges on generating plant. In water works practice, neither public or private fire protection service has any part in the actual peak demands on the system although in the case of public fire protection the extra requirements for this service can be calculated and a commensurate part of the plant and property can be assigned to public fire protection. The latter approach, however, is not quite so applicable to private fire protection. As with street lighting in the electric rate problem, the assignment of property costs to private fire protection requires the use of judgment. Neither is a large part of the total cost of service rendered. It would seem logical for the rates in either case to be predicated on the value of the service in relation to other things. In the case of private fire protection service, for instance, this value might be related to the savings in the form of reduced fire insurance premiums.

The Cost-Quantity Relationship

A determination of a cost-quantity relationship for water sold throughout the whole consumption range has always seemed to be the proper approach to a water rate problem. If property of the water utility can be apportioned to groups of customers on a peak load basis, it would seem that there should be a way for these apportionments to be passed on to customers within the groups on the same basis, and that it should be possible to combine the costs so determined with other costs and in this way to establish the true cost of water throughout the whole range of consumption, and therefrom to fashion a rate that fits the cost-quantity relationship. Most of the expenses of operation and the property costs on meters and services can be distributed in this manner. Other property costs are the stumbling block. To effect a distribution of property costs on the basis of peak loads or load factor, and speaking for the moment only of rates for residential uses, it would be necessary for the rate to take into account the fact that a certain group of consumers in a particular consumption range are responsible for a certain addition to the system peak load. Furthermore, it would be necessary for the cost fixed by that load increment to be spread over consumptions at high levels in the summer time and over lower levels for the remainder of the year, and that consumers in another consumption range would have another peak load increment requiring similar treatment. However, the problem should not be insoluble. Since the load factor element of the problem has apparently been neglected, the author doubts that the cost-quantity relationship has ever been studied or analyzed as accurately as it deserves to be. An accurate solution would require more statistical information covering the character of residential consumption than has been reported by any student of the subject up to the present time. It does appear that studies along this line would be helpful to the whole cause of rate making for water works properties.

Minimum Charge Seems Most Applicable

Such explorations as the author has made into this part of the rate problem have caused him to wonder whether a real accurate appraisal of the matter might not disclose that the upper reaches of residential consumption should be charged with property costs in a way that would tend to offset those fixed costs generally thought of as constituting justification for the service charge which is applied at the opposite end of the consumption range. The pattern of peak load demands of the larger residential properties seem definitely to point in that direction. At any rate, these are the considerations that have caused the author to conclude on the basis of evidence now available that refinement in rates for the residential-small commercial group beyond a uniform price per unit of volume for all water consumed is unwarranted; and that the minimum charge method is preferable to the service charge method as a means of insuring reimburse-

ment for certain expenditures made for this group, whether water is or is not used. A part of the reasoning in support of the latter conclusion is that the assessment of specific costs at the bottom of the consumption range through the medium of the service charge appears, in light of present knowledge of costs throughout the whole consumption range, to imply that a degree of accuracy is justified in the calculation of these costs that simply does not exist.

The author therefore proposes the simpler rate pattern illustrated in the following form:

Residential Rate

For all water used ..... 25c per 1000 gals.

Minimum charge

⅝" meter	75c	per month
¾" meter	1.00	" "
1" meter	1.25	" "
1½" meter	2.25	" "

Industrial Rate

For the first 25,000 gals. per month	25c per 1000 gals.
For the next 225,000 " " "	12c per 1000 "
For all over 250,000 " " "	9c per 1000 "

Plus a service charge based on meter size as follows:

⅝" meter	$0.75 per month	2" meter	$ 3.50 per month
¾" meter	1.00 " "	3" meter	6.50 " "
1" meter	1.25 " "	4" meter	10.00 " "
1½" meter	2.25 " "	6" meter	18.00 " "

If water consumption per month is plotted against cost when using the residential as against the industrial rate, as is shown in Figure 3, it will be evident that difficulties with the application of the two rates will center in the intermediate consumption range either side of the point where the cost for service to customers served with ⅝, ¾ and 1-in. meters is the same under either rate—i.e., where the lines cross on Fig. 3. Apparently the two part rate plan will work best if customers using meters in the ⅝, ¾ and 1-in. sizes are permitted to choose one or the other rate pattern most to his liking, while customers using meters 1½ in. or larger in size be required to accept service under the industrial rate, and all single and double family residential customers be required to accept service under the residential rate regardless of meter size or consumption. First, it should be pointed out that the point of equal cost under either rate can be moved either way in the consumption range by simply changing the quantity of water in the first block of the industrial rate. On the basis of the application rules just stated, it would seem most sensible to fix the equal cost point somewhere near the upper range of residential consumption. Certainly it would seem that it should be placed so that less than a fraction of one per cent of the readings would exceed the consumption at the equal cost point. With the equal cost or crossover point at 31,000, 33,000 and 35,000 gallons per month for ⅝, ¾ and 1-in. meters, respectively (see Fig. 3), there should be less than a fraction of one per cent of customers using ⅝ in. or ¾ in. meters that would be served under the industrial rate; a very negligible percentage of customers using 1 in. meters might find it a little difficult to choose the rate of least cost and all other industrial customers should have very infrequent readings below the equal cost point.

Methods To Be Followed in Developing the Two Rates

The description of this rate plan can hardly be rounded out without some more explanation of the methods to be followed in the fabrication of the rate. Fixed charges on property chargeable to fire protection are assumed first to have been set aside on the basis of an apportionment plan that cannot be described within the scope of this article. The rate for residential service is then derived from the sum of that group's share of commodity cost based on the relative amounts of water used plus its share of consumer cost which is made up of meter reading, billing, collecting and meter repair costs based on the number of consumers in each group and the size of the meters serving them, plus its share of the remaining property costs based on its relative contribution to system peak loads. The average rate thus determined, adjusted for the effect of minimum charges, is applied to all water used by residential consumers. The minimum bill is made to agree with or to be consistent with the service charge determined for the industrial consumers as described below. There is no compelling reason for this agreement except that the minimum charge and the service charge are understood in a way to cover the same costs and for the further reason that charges thus determined are in keeping with current practice.

Calculations for the industrial rate revolve around the service charge. The author is not prepared at this time to describe a basis for these charges that can be stated in a thoroughly definite and logical manner. His present conception of the proper service charge is that it should be high enough to discourage meter over-sizing but low enough not to appear unreasonable or too burdensome. These charges are expected to cover meter reading, billing, collecting, meter repair and fixed charges on services and meters but the summation of these costs is not enough to accomplish the purpose mentioned. If the charge is made to cover fixed charges on all of the property devoted to the customer's use the charge seems too high.

The commodity rate enters into the picture. The first 25,000 gallons or so should be priced at the residential rate so as to bring about a fair agreement between the two rates up to the crossover point (see Fig. 3). The use of a tail rate about 25 per cent in excess of bare calculated commodity cost tends to fix the amount of property fixed charges to be distributed through the second commodity step and the service charges. The author's present notion is that the service charges ought to come within the range of about $25 to $40 per year per 100 gpm. of meter capacity. At the lower level apparently about 20 per cent of the fixed charges on property devoted to the use of industrial consumers is collected through the service charge. At the higher level this figure is increased to about 35 per cent. A few rates now in use include service charges ranging as high as $50 to $60 per year per 100 gpm. of meter capacity. The Milwaukee rates, which are among those of most recent revision, provide for service charges measuring $25 per year per 100 gpm. of meter capacity for all sizes of meters. The charges included in the rates stated above average about $25 per year, but the rate is higher for the small meters than it is for the larger meters. The provision for the collection of a greater percentage of fixed charges by means of the service charge might add some to the difficulty of application in the sense that it would cause a greater spread between the two rates at the lower end of the consumption range. However, this should not be a matter of serious consequence since nearly all customers should be able rather readily to choose the rate of lowest cost when the characteristics of the two alternate rates are properly explained to them. [And incidentally this service in the customer's interest, regardless of the size of saving to him, may prove to be an important brick in the public relations structure of the water utility.—Ed.]

Parts of the service charge can be calculated with more accuracy than

is indicated by the suggestion that the charge should be related to meter capacity. The known costs that the charge should provide for have been named. If proper consideration is given to factors bearing on these costs (such as that of meter repair cost, etc.) the charge should reflect a true average cost, that some meters are read monthly and some at other intervals, and that it costs more to read scattered industrial meters than it does to read meters in residential sections, then costs will follow the pattern shown in Figure 4. The sum of these costs for smaller meters will be higher per unit of capacity than that for larger meters. This will help, though possibly in a small way, to discourage multiple metering by the larger industries. The author proposes to fashion the final service charge out of these known costs, plus a fairly uniform charge per unit of meter capacity as is shown in Fig. 4.

The author realizes that the above discussion of rates neglects the very important matter of water used for cooling in air conditioning operations. It is evident that the demands for such uses would have an important bearing on the industrial rate depending on the percentage of water used in this way. This is a subject of too much depth and breadth to be included in this discussion.

The author has developed this rate plan in the belief that it has a place in the scheme of things, that it is to be preferred over a plan making exclusive use of either the service charge or the minimum charge and in the hope in any case that it may be a spur to some new thinking about rates for water service.

SIXTEENTH ANNUAL ARKANSAS WATER & SEWAGE CONFERENCE WELL ATTENDED*

16th Annual Arkansas Water and Sewage Conference, Fayetteville, Ark., April 14, 15, 16, 1947
A portion of the 103 *registered attendance.*

The Sixteenth Annual Arkansas Water and Sewage Conference drew 103 registered members at its April meeting, held at the Student Union of the University of Arkansas at Fayetteville, Ark. Those registered represented 46 Arkansas towns and cities, or about 20 per cent of the total number of cities in the state having public water supplies. (There are 182 public water supplies and 111 sewage disposal plants in Arkansas.)

Officers elected for the ensuing year are: Chairman, J. R. Pierce, Pine Bluff; Vice-Chairman, Nel B. Thayer, Jonesboro; Secretary, Harrison Hale, Fayetteville; Program Committee, Ed. F. Byerley, West Helena; Executive Committee, W. R. Spencer, Chairman, Fayetteville; A. J. Ables, Hampton; Frank Daniels, Siloam Springs; E. E. O'Fallin, Forrest City; H. R. Ritter, Marked Tree; and J. G. Wood, Texarkana.

Five conference sessions were held prior to the annual dinner. During the sessions, there were two very interesting open discussions. The first, on Distribution System Problems, was led by Jack Wilson, Engineer, Municipal Water Works, Little Rock, and the second, on Sewage Problems, was directed by Ben W. Dees of Marion L. Crist and Associates, Little Rock.

A committee was appointed with power to arrange for certificates for work done in special correspondence courses for water works men. This work may be given through the General Extension Division of the University of Arkansas. Cooperation was pledged to the Arkansas Municipal League. Tribute was paid to Walter A. Reiman, formerly Chief Engineer of Arkansas State Board of Health, who died in the LaSalle Hotel fire.

The conference dinner, held on the closing evening, was addressed by C. F. Byrns, Editor of both the Southwest American and the Times-Record of Fort Smith. Mr. Byrns spoke on "A Newspaper Editor Looks at His Town's Water Supply," and emphasized the fundamental importance of an abundant and satisfactory water supply to a city, as well as the essential part water plays in the development of a state. As Secretary of the Arkansas Resources and Development Commission, Mr. Byrns has been in a position to note the large increase in new industries within the state in recent years, and the effect that satisfactory water supply has had on this increase.

*Notes and photo supplied by Harrison Hale, Secy., Ark. Water & Sewage Conf., Fayetteville, Ark.

ARIZONA SEWAGE & WATER WORKS MEETING

Held April 11th and 12th in Douglas

A Report by
A. M. RAWN*
Editorial Associate

SOME seventy-five members and guests registered at Douglas, Arizona for the Spring Meeting of the Arizona Sewage and Water Works' Association on April 11 and 12. The two days were fully devoted to presentation and discussion of technical and informative papers on both water supply and sewerage and a brief visit to a newly constructed separate sludge digestion-trickling filter plant built by the International Boundary Commission to serve the cities of Douglas in Arizona and Aqua Prieta across the International Line in Sonora, Mexico.

The mayor of Douglas extended a warm welcome to the Association and discussed briefly the position that Douglas was assuming among cities in Arizona. Past history of the city was effectively brought out in **J. R. Denny's** discussion when he traced the development of the city and the water works from 1900, when the town site was platted, stating that the incorporation of the city in 1905 witnessed the drilling of the fourth well to serve the city's population.

In 1910 the city bought the water works for $225,000 taken from the proceeds of a 5 per cent, twenty-five year municipal bond issue, and the speaker stated that profits from operation had repaid the loan in its entirety. Storage to the extent of 300,000 gallons was installed in 1911 and the pumping rate increased to 1500 gpm. Continuing his discussion, Mr. Denny related how the Water Department had since that time not only increased the supply and storage facilities, but had taken over the city parks and the sewerage system, and had recently purchased and was also operating a cemetery as a municipal enterprise.

Of interest was the fact that 18.2 per cent of all the water developed had been used by the city, for which the city had paid nothing and, that since its inauguration, the Water Department had discharged $1,158,-326 of the city's obligations not related to the water supply.

The Flourine Problem in Arizona

Continuing the discussion of water, **C. T. Dixon,** of the Arizona Edison Company, described the efforts of his organization to secure for the citizens of Coolidge a good water supply of low flourine content. Mr. Dixon stated that, while it is fairly well established that flourine not exceeding one part per million in water is beneficial to the individual, concentrations much in excess of this produces mottled enamel in teeth particularly in the very young, and that water with a low flourine concentration is greatly to be desired and, at times, extremely difficult to locate in certain areas of Arizona.

In the Casa Grande Valley, in which the town of Coolidge is located, flourine exists in all waters in varying degrees of concentration and, unfortunately, there are wells in which a low flourine content at the start increases materially after a period of use and compels abandonment of the well. In seeking new supplies, some forty different wells in the desired area were sampled, eighteen of which indicated a low enough flourine concentration for re-analysis which finally limited the desirable wells to a scant half dozen.

An attempt to purchase these good wells was futile; their value having increased in proportion to their desirability. The company purchased land in the area, drilled its own wells and has now developed an adequate and ample supply. Incidentally, none of the characteristics common to wells appear to indicate when and where flourine will be found. An attempt to correlate on the basis of depth, temperature, soil conditions, location, hardness, salt concentration, or any others do not supply the prospector with telltale information. He had concluded that flourine-free water, like gold, is where you find it.

Edwin W. Barbee, Water Purification Engineer for the San Francisco Water Department, discussed the more interesting parts of a paper formerly presented to the American

*Chief Engr. & Gen'l Mgr., Los Angeles County Sanitation District.

Members and Guests—Arizona Sewage & Water Works Ass'n.

(That Douglas sunshine looks good to us.—Ed.)

The International Sewage Treatment Plant of Douglas, Ariz.
(A brand new plant built by the International Boundary Commission to serve Douglas, Ariz., and Aqua Prieta, across the border in Old Mexico.)

Water Works Association and published in the March 1947 issue. The speaker illustrated his discussion with slides and diagrams and carried his conclusions a little further than in the paper previously presented. The title of Barbee's paper, "Studies in the Measurement of Tuberculation as an Index of Corrosion and Anti-Corrosion Treatment for Control" will be reminiscent of the previous presentation at San Francisco last October.

The Round Table discussion of this paper centered around the effect of residual chlorine on the rate of tuberculation; physical character of oxidation products; loss in weight vs. resistance head increase; model factor to apply to prototype, etc.

R. F. Goudey, life member of the Arizona Sewage and Water Works Association and Sanitary Engineer, Los Angeles Water Department, concluded the discussion of water problems by summarizing sound methods of publicity and public relations for Water Authorities. Mr. Goudey stated in part that every local community has its own best method of promoting its interest in water works, but the American Water Works Association is attempting, through the issuance of bulletins, to direct the water works executive and employee into sound public relations channels. "You and I can make or break a water department. Good work and prompt decisions, pride and loyalty are essential to the success of a water works organization," said the speaker.

Goudey recommended that wide publicity be given the low cost of good water; that in any water department each employee know what is involved in the other fellow's job; should understand the rules of service; should have available to him a publication of the department with wide and varied topics, and that public talks on water works and supply should be given to the younger generation of future voters by water works employees of ranks lower than management. He concluded by stating that radio and television are of great importance in publicity because the listeners to technical programs are usually of the highest order of listener intelligence.

Sewerage Topics

On the sewerage side, **Richard Bennett**, Hydraulic Engineer, City Engineer's Office in Phoenix, speaking on maximum sewage flow for sewer design, directed attention to the inconsistency of attempting to use factors, applicable to one locality, in another. His search for data which might be used in design for the sewers of the City of Phoenix led him to believe, for instance, that a hundred gallons per capita average daily flow might be appropriate to population densities such as existed in the Phoenix area and elsewhere. In an article entitled "Sewer Design—1939 Model" he determined that average water consumption might be assumed at 95 gallons per capita per day; sewage flow 70 per cent thereof, flowing at a maximum rate of 285 gallons per day for areas of five acres or less; 245 gallons per day for areas of a hundred acres or more.

Having a suspicion that these factors were not applicable to Phoenix, the city employed an engineering firm to accurately measure flows in existing sewers in the city and found that, based on the average water consumption of 330 g.p.c.d., the maximum sewage flow was 168 gallons and the average, 142 gallons per day.

Summarizing, Bennett stated that

On the Inspection Trip

(1) *Richard Bennett, Phoenix, Ariz.*
(2) *B. D. Phelps, San Diego, Calif.*
(3) *E. W. Barbee, San Francisco*
(4) *Otto Bejeck, Los Angeles*
(1) *R. F. Goudey, Los Angeles*
(2) *R. F. Poston*, Douglas, Ariz.*
(3) *Everett Jones**, Douglas, Ariz.*
(4) *A. M. Rawn, Los Angeles*

**Designer of the Douglas International Treatment Plant.*
***Mayor of Douglas.*

of importance among the factors influencing sewer design were:

1. The general wealth and nature of the area being served.

2. The ratio of maximum to average flows dependent upon the size of the contributing area.

3. Special consideration for schools, commercial industrial areas, and ground water infiltration.

4. Zoning regulations.

Bennett stated further that population density is a minor factor under conditions such as exist in Phoenix and that straight line sewage flow formulae applicable to cities where they originated are not to be used indiscriminately in the design of systems for other localities and particularly in the southwest.

The Autoxidation Process

Enlarging upon discussions previously presented on the use of the Autoxidation Process of preparing sulfuric acid and sulfate of iron for use in sewage treatment, **Harmon E. Keyes,** Consulting Chemical Engr. of Phoenix, Arizona, described how ferric sulfate might be used in the treatment of irrigation waters to prevent over-alkalinity in soils and, in fact, how alkaline soils might be restored to useful agricultural purposes by direct treatment with the iron sulfates.

The speaker first related how the

New Autoxidation Plant Phoenix, Ariz., Sewage Treatment Plant

(Sulphur burner and autoxidation cell (center) and scrap-iron contact tank on the ground.)

Autoxidation Process would produce sulfuric acid from sulfur at a cost approximating 50 per cent of the commercial product; described how this could be converted to iron sulfate cheaply, using scrap iron; described the soil chemistry which produced alkalinity and illustrated his comments by exhibiting restored alkaline soils now successfully growing cotton and other seedling plants.

Discussion of the paper centered around the possible destruction of concrete structures if the irrigation waters were acidified with acid iron salts and the base exchange qualities of certain soils when irrigated with water in which the sodium radical was out of balance. Many thousands of acres in the irrigated west are being abandoned because of an over-abundance of alkali in the soil; and a means for restoring these to useful purpose, at a price which is commensurate with their restored value, is of great importance and formed the theme of Mr. Keyes' paper.

Additional discussion centered around the use of "Chloroben" in sewage treatment with particular reference to experiences had in Los Angeles and Long Beach. A paper relating to this topic was presented by J. L. Todd and J. T. Leggett and constituted an extension of a paper by A. A. Appel presented in November 1946.

Papers by Yost of Phoenix on cone valves and Ladlow of Phoenix on experiences with small sewage treatment plants were followed by a trip of inspection to the newly constructed Douglas Sewage Treatment Plant, concluding the two-day session.

The Gasden Hotel at Douglas was the headquarters for the convention. At the close of the meeting Robert M. Cushing, Sanitary Engineer of Phoenix, Arizona, yielded the presidency of the Association to Harold W. Yost, Consulting Engineer, Phoenix, elected for the coming Association year.

New England Section A.W.W.A. Elects Officers

At the annual meeting of the New England Section of the A.W.W.A. on March 20 in Boston, officers for the ensuing year were elected. These included the following:

Chairman
Fred J. Reny
Treas. & Mgr. Water Distr.
Portland, Me.
Manchester, N. H.

A.W.W.A. Director
Percy A. Shaw
Engr. & Supt. Water Dept.

Chairman, Fred J. Reny, Treas. and Gen. Mgr., Portland Water District, Portland, Me.; Vice-Chairman, William B. Duffy, Supt. Public Works, North Andover, Mass.; Secy.-Treas., Richard H. Ellis, Hydraulic Engineer, Associated Factory Mutual Fire Insurance Companies, Boston; A.W.W.A. Director, Percy A. Shaw, Supt. and Chief Engr., Water Works, Manchester, N. H.

Trustees of the Section include Warren A. Gentner, Deputy Mgr. and Deputy Chief Engr., Water Bureau, Hartford, Conn., and Charles B. Hardy, Supt. Bureau of Water, Worcester, Mass.

No technical session was held at this meeting.

N. Y. State Analyzes Consumer Complaints

In the first-quarter issue of the 1947 "Water Works News of New York State," published by the N. Y. State Dept. of Health, there is an article on what consumers complain about, why they complain, and what waterworks men might do to combat such complaints.

The article lists eight items which might cause complaints. Included in these are water rates generally complained about because they are not justified by the services being rendered.

As immediate measures to offset these complaints, the report suggests improvement in the distribution system to offset low pressure, treatment to remove taste and odor, filtration to remove turbidity, and other foreign objects, and treatment to remove iron, manganese, and hardness and to eliminate corrosive water.

Chapman Heads New Water Works Company

Gilbert W. Chapman, Vice-Pres. of American Water Works and Electric Co. in New York, was made President of the new American Water Works Co., following the segregation of the water companies from the electric, gas, transportation, and other businesses in the system. Mr. Chapman has been connected with the parent body since 1927, but in recent years has devoted practically all of his time to work in the water works field.

A.W.W.A. PRESENTS THE SAN FRANCISCO PROGRAM

For the 67th Annual Meeting in the Civic Auditorium July 21-25, 1947

"Meet me at the Well"

FROM all indications the simultaneously scheduled San Francisco Conventions of the American Water Works Association and the Federation of Sewage Works Associations during the week of July 21-25 are to draw an exceptional attendance if requests for hotel accommodations mean anything—and they usually do.

Many have asked why the midsummer period was chosen for these meetings. The answer is that the San Francisco climate is ideal in July and it is even advisable to take along a warm raincoat or a light topcoat, since it is apt to be cool enough in the Bay Region to render a topcoat desirable in the evenings if not during the day. It never gets really hot in San Francisco and straw hats until recent years have been a rarity. The ladies should go prepared for cool evenings if not cool mornings also. If you have heard of San Francisco's fogs don't go expecting to see anything "soupy" such as we experience in the east. The Bay Region fogs are usually what are termed "high fogs". The fog resembles an over-cast day in the east and by noon the sun burns through to produce a lovely day. At night the fog may gather again unless it goes out to sea to stay awhile. The San Francisco climate all summer is as refreshing and invigorating to plants and flowers as well as man, so the San Francisco region is a garden spot of beauty, and gorgeous flowers and plants sell for a pittance as compared to eastern prices.

San Francisco has its incomparable Chinatown with its exotic eating places and alluring oriental merchandise. One of the accompanying views shows the always interesting cable-cars on California St., and the edge of Chinatown with its Hotel Yamoto and a Chinese apartment across the street. Speaking of San Francisco's streets that are so steep as to necessitate cable-cars, one wonders what happens to traffic in case of snows or icy paving. The answer is that San Francisco has neither.

Anyone who enjoys "adventures in eating" will find no comparable city when it comes to the variety and number of interesting places to dine and wine. On the whole the city of the Golden Gate is the ideal vacation city and convention spot, and many who at first thought that they could not stand the expense of a trip to the Pacific Coast in this year of high living costs are combining the two objectives—a vacation, with a water and a sewage works convention thrown in—and are spreading the expense of the trip accordingly. Some are planning the trip as the family vacation for 1947 and 1948 combined, with the family agreeing that the cross-country trip, a glimpse at America going and coming plus a week or more in fabulous California, will be worth it.

As to what is in the cards for those who wish a preview of the technical program for the A.W.W.A.

Civic Auditorium Where Meetings Will be Held

Conference this summer, it is herewith presented in its completed form.

THE TECHNICAL PROGRAM

MONDAY, JULY 21

[Forenoon]

Committee Meetings

The Colorado River—What It Means to the Southwest
—S. B. Morris

Water Supply Developments in the Pacific Islands
—Frederick Ohrt

Hydro-Pneumatic Pumping Stations
—O. G. Goldman

[Afternoon]

JOINT SESSION
MANAGEMENT AND ACCOUNTING DIVS.

Recent Revenue Bond Legislation
—L. N. Thompson

Experiences in Revenue Bond Financing
—S. B. Robinson

How Shall Rate Structures Be Adjusted to Meet Rising Cost Levels?
—L. R. Howson

Water Main Extension Policy

W. V. Weir	M. P. Hatcher
F. R. Berry	E. F. Dandridge
L. S. Finch	C. M. Hoskinson

PURIFICATION DIVISION

Selection and Control of Distribution System Sampling Points
—K. W. Brown

Water Main Disinfection—Why and How?
—C. K. Calvert

Report of Committee on Open-Air Reservoirs
—N. J. Howard

Pollution of Potable Water by Macroscopic Organisms
—J. C. Weart and C. W. Klassen

TUESDAY, JULY 22

[Forenoon]

GENERAL SESSION

Applying Business Principles to Water Works Operation
—G. E. Arnold

Value of Public Service Commission Control to Municipal Water Works Management
—A. P. Kuranz

Scintillating San Francisco at Night
(The String of Lights Is on Oakland Bay Bridge)

The Washington Suburban Sanitary District—Twenty-eight Years of Operations
—H. R. Hall and H. B. Shaw

Water Works Rules and Regulations—What Should They Contain?
—M. P. Hatcher

PURIFICATION DIVISION

Disposal of Wastes from Water Purification and Softening Plants
—W. W. Aultman

Separation of Water from Solid-Liquid Mixtures
—A. A. Kalinske

Control of Slime Growth in Transmission Lines
—R. L. Derby

Superchlorination and Dechlorination Experiences
—C. J. Lauter and N. J. Howard

[Afternoon]

JOINT SESSION
A.W.W.A. AND F.S.W.A. GROUND WATER POLLUTION PROBLEMS

Basic Concepts in Ground Water Law
—A. P. Black

Ground Water Production Works
—Malcolm Pirnie and R. W. Sawyer

Formulating Legislation to Protect Ground Water from Pollution
—B. E. Doll

Developing Standards for Protection of Ground Water from Pollution
—R. F. Goudey

WEDNESDAY, JULY 23

[Forenoon]

GENERAL SESSION

The Program of the A.P.H.A. for Engineering Personnel
—W. T. Ingram and F. B. Elder

Upgrading the Water Works Industry
—J. H. Murdoch

Engineers' Organizations for Labor Bargaining Purposes
—S. S. Green

The Significance of Anti-Strike Legislation Directed Toward Public Employees
—W. R. LaDue

[Afternoon]

JOINT SESSION
F.S.W.A. and A.W.W.A. RECLAMATION OF SEWAGE EFFLUENTS

Industrial Uses for Reclaimed Sewage Effluents
—N. T. Veatch

Use of Reclaimed Sewage Effluents of Baltimore
—Abel Wolman

Agricultural Uses for Reclaimed Sewage Effluents
—L. V. Wilcox

Limits of Pollution of Water for Industrial Uses
—S. T. Powell

Unique California St. Retains Its Cable Car Line of Gold Rush Days
(On the Right Is Chinatown's Hotel Yamoto)

THURSDAY, JULY 24

[*Forenoon*]

JOINT SESSION
MANAGEMENT AND ACCOUNTING DIVS.

Testing Materials and Equipment for Water Works Construction and Operation
—W. W. DeBerard and H. P. Hagedorn

Fifteen Years Progress in Leak Prevention
—J. B. Eddy

Long Line Hydraulic Studies
—F. C. Scobey

Experience with Steel Pipe Lines After Lining in Place
—Wm. G. Banks
(Discussion by W. R. LaDue)

[*Afternoon*]

GENERAL SESSION

Lessons in Water System Design Derived from World War II
—H. S. Swanson and S. A. Evans
(Discussion by L. H. Enslow)

Erosion Control in Mountain Areas of California
—C. J. Kraebel

Erosion Control in Watersheds of the East Bay Municipal Utility District
—L. S. Hall

Erosion Control in Watersheds of the Los Angeles Department of Water and Power
—B. S. Grant

PURIFICATION DIVISION

Operating Characteristics of Synthetic Siliceous Zeolites
—L. Streicher, H. E. Pearson and E. A. Bowers

Use and Interpretation of Langelier Stability Diagram
—W. B. Lawrence

Calculation of the pH of Saturation of Tricalcium Phosphate
—J. Green and J. W. Ryznar

Chemical Fixation of Oxygen in Industrial Water Supplies
—D. J. Pye

FRIDAY, JULY 25

[*Forenoon*]

GENERAL SESSION

The Use of Radio in Water System Operation and Maintenance
—A. Damiano
(Discussion by B. A. Currie and W. C. Morse)

Should Public Water Supplies Be Used as Means of Mass Medication?
—Abel Wolman

Inter-Industry Problems Derived from Cathodic Protection
—F. R. Dolson
(Discussion by L. J. Alexander and F. D. Pyle)

Municipal vs. Residential Water Softening
—D. L. Maffitt
(Discussion by H. M. Olson)

To All Former Sanitary Corps Officers

To all former Sanitary Corps Officers, and those still on active duty:

Communicate with Colonel M. J. Blew, giving rank; when called to active duty; present rank or rank on separation; specialty (engineering, bacteriology, chemistry, etc.); a resumé of pertinent facts regarding active duty assignments; academic and professional degrees; professional and honorary Society affiliations; whether registered or certified, etc., and any further comments or suggestions desired.

This information is desired to complete an accurate post-war roster and is also needed for preparing an analysis and evaluation of the activities and contributions of the Corps during the war. Existing information is inaccurate and incomplete and the cooperation of all officers and former officers is desired.

Send reply to Colonel M. J. Blew, % National Soc. of Professional Engrs., 1359 Connecticut Ave., N. W., Washington 6, D. C.

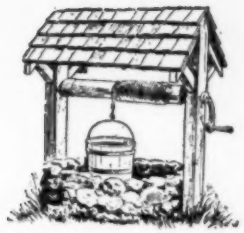
O'K. Myers, Resident Engineer in Guayaquil

O'Kelly Myers, formerly Senior Division Engineer with the Board of Water Supply of New York City, is now Resident Manager for Buck, Seifert and Jost, consulting engineers, with headquarters in the City of Guayaquil, Ecuador, where he is engaged on investigations for a new water works system to serve that city.

Mr. Myers has a long experience record in sanitary engineering, having been on the staff of the late Nicholas S. Hill, Jr. at one time, and later a consulting engineer on various water supply and sewerage projects. Myers was also Senior Division Engineer on the construction of the Delaware Aqueduct for the City of New York. During the recent war, he was engaged on studies and design of a water supply system for the Naval Base at Ensenada Honda, Puerto Rico and similar assignment at Nassau, B.W.I.

FEDERATION PROGRAM NEARS COMPLETION

Joint Sessions With A.W.W.A. Expected to Be Highlights



"Meet me at the Well"

PREPARATIONS for the Twentieth Annual Meeting of the Federation of Sewage Works Assns. to be held concurrently with the 1947 Conference of the American Water Works Assn. in San Francisco are nearing completion. More than 1200 hotel reservations had been assigned by the middle of April, and it is expected that the total registration for the two meetings will top 2000.

Program Nearly Completed

Final details of the clearing of the technical program are nearly completed at this time according to the Chairman of the Program Committee, F. Wellington Gilcreas. Two sessions to be held jointly with the A.W.W.A. on Tues. and Wed. are expected to draw considerable interest. The first of these joint sessions will be held on July 22 in the afternoon with the A.W.W.A. acting as the host. That program will be dedicated to the topic of "Ground Water Pollution."

The Wednesday afternoon session held jointly, with the Federation acting as host will be devoted to the topic "Reclamation of Sewage Effluents." Speakers scheduled for participation in this symposium include N. T. Veatch, Earnest Boyce, Abel Wolman, L. V. Wilcox, Dario Travaini and others yet to be selected.

The Tuesday morning session (July 22) will feature papers describing the sewage works improvements and development at San Francisco and Portland, with the former being presented by Clyde C. Kennedy, and the latter to be a joint paper by J. E. Stevens and H. L. Thompson with a discussion by A. M. Rawn. The annual business session will be held prior to the presentation of these papers.

The Wednesday morning session (July 23) will consist of papers on stream pollution and industrial wastes. There is one paper yet to be secured for that session but to date the following persons have accepted assignments: F. W. Kittrell, George E. Symons, W. J. O'Connell, Jr., and W. T. Knowlton.

The morning session on Thursday will be devoted to the Annual Operators' Forum. This session will be under the auspices of the California Sewage Works Assn. which is making all the arrangements for the discussion. Items to be stressed will include industrial waste problems, plant maintenance, and operation kinks.

The final session will be held on Thursday afternoon. Although it will be an abbreviated session, its importance cannot be too greatly stressed for it will deal with a symposium on the B.O.D. determination. Recent studies and developments in connection with this test will be presented by Harold B. Gotaas, W. F. Langlier, David H. Caldwell, and R. G. Tyler.

Exhibits

With more than two months to go, exhibit space has practically all been spoken for. As a matter of fact the arena is filled and some booths are now scheduled to be set up in the corridors. Ninety-seven companies have been scheduled to use 154 booths as of May 1, and inquiries were still being received by the Water and Sewage Works Manufacturers Assn. Without doubt this will be the most elaborate and comprehensive series of exhibits yet to be staged in connection with these meetings.

Entertainment

Throughout the week there will be social events and entertainment, affording a variety of quality entertainment.

Monday Night, July 21. "Presidents' Reception and Dance," joint "Get Together and Get Acquainted" function with some form of home talent at the St. Francis Hotel.

Tuesday Night, July 22. "Gala Night" Entertainment. A joint function of A.W.W.A. and F.S.W.A. at the Auditorium Arena Stage, all under the direction of the incomparable "Bill" Orchard, whose record of memorable entertainments is well known to members of both organizations.

Wednesday Night, July 23. Annual Dinner of Federation of Sew. Wks. Assns. at the St. Francis Hotel.

Also—Joint Dance, A.W.W.A.-F.S.W.A. at the Francis Drake Hotel.

Thursday Night, July 24. A.W.-W.A. Annual Dinner and Dance at the Fairmont Hotel.

Ladies' Entertainment

Although arrangements have not yet been completed it is expected that there will be special events for the ladies on Tuesday, Wednesday, and Thursday afternoons. This entertainment will include teas, luncheon, bridge, and special tours—and plenty of time for shopping and sight-seeing.

Hotel and Transportation Reservations

Members of both organizations have been furnished blanks for applying for hotel reservations. Additional forms are available either from the American Water Works Assn., 500 Fifth Ave., New York 18, N. Y., or from the Federation of Sewage Works Assns., 325 Illinois Bldg., Champaign, Ill.

Transportation reservations for special trains should be made with the transportation committee. Information may be obtained from E. A. Sigworth, Gen. Chairman, Transportation Comm. % Industrial Chemical Sales Div., 230 Park Ave., New York.

Members of either organization should make reservations as soon as possible both for hotel accommodations and transportation.

THE FLOODING OF THE LEA BRIDGE WORKS OF THE METROPOLITAN WATER BOARD OF LONDON

A Happening of March 15th, 1947, which Shut Down These Important Works for First Time in Their History, and for Nine Days Thereafter

By FRANK WOOD*
Deputy Mechanical Engr.
METROPOLITAN WATER BOARD
LONDON, ENG.

SEVERE wintry conditions, the worst of the present century, prevailed throughout the British Isles during the months of January, February, and the early part of March, 1947. A considerable amount of snow had fallen, amounting to several feet over large areas, accompanied by hard frost. The thaw, which was sudden in the Southeast of England, commenced on Monday, March 10th; it continued rapidly and was accompanied by fairly heavy rainfall, amounting to approximately 1¾ inches in the River Lea watershed, which has an area of 600 square miles. Due to the hard nature of the ground the run off was high. The Lea is but a small river 56 miles long, half of which is navigable and has a normal daily average flow of approximately 100 million gallons (British) per day. At the time of the flood this flow must have been twenty fold this volume. In any event it was the highest on record, or in the memory of the oldest inhabitants of the valley.

*Assoc. Member, Inst. of Civil Engrs. and Inst. of Mechanical Engineering; Member, Inst. of Water Engrs.

The Lea Bridge Works

The works of the Metropolitan Water Board at Lea Bridge, Clapton, E. were constructed in 1854 by the late East London Water Company. These works have for many years supplied about 45 million gallons per day to the immediate neighborhood. They cover 80 acres of which 25 acres are occupied by slow sand filter beds; each bed has an area of 1 acre.

The water is conveyed to the works by means of an open aqueduct, 2 miles long by 36 ft. wide, from the raw water storage reservoirs situated in the Upper Lea Valley.

At the time of the flooding the output of the works was approximately 38 mgd., or sufficient to meet the needs of a population of about 1,000,000 people, together with considerable industrial, dock and shipping use. The area served is divided into three pressure zones for distribution purposes, these being supplied either by direct pumping to the mains or by combination of reservoirs and auxiliary pumping stations.

The River Lea flows through the works. Situated within the works near three of the pumping stations are the flood control sluices, seen in one of the pictures fully open but submerged for the first time in their history.

Flooding

On Thursday evening, March 13th, the flow down the River was very high; most of the flood-gates at Lea Bridge had been lifted but still the level in the river passing through the works had risen about 10 feet. During that night the river rose still further and at 9 a. m. on Friday, March 14th, overflowed its banks into the Board's works and submerged some of the filtered water suction wells. Due

The River Lea on Its History Making Rise March 14th, 1947
The worst came 24 hours later, March 15th, when in the gray dawn it broke over and closed down the Lea Bridge Works completely.

Flood Control Sluices of the Lea River at the Lea Bridge Works
Although fully drawn, the relief gates are already submerged with worse to come.

to prompt action on the part of the resident staff in isolating this portion of the works, a complete shut down at the time was avoided, but the output of the works was restricted by about 8 mgd.

The staff of the Water Examination Department immediately increased the dose of chlorine to the water leaving the works from 0.5 ppm. to 1.00 ppm. and began extra sampling to assess the damage done.

During the night of Saturday, March 15th, the River Lea again rose rapidly and broke through into the main supply aqueduct feeding the works. The flood waters surged down to the works and at 5:30 a. m. completely inundated the whole area of the works to depths varying from 1 to 4 feet.

The works were immediately shut down and for the first time in their history ceased to supply water, thus depriving at least 1,000,000 people of their normal water supply. Hitler at his worst did not achieve this.

On its way downstream the flood also put out of action the deep well pumping stations at Waltham Abbey and Chingford which, together, supply a further 2½ mgd. to the affected area.

Immediate Measures

After the shutting down of the works, steps were at once taken to provide alternative supplies. It was possible to maintain between 50% and 60% of normal pressure in the low zone by the transfer of water from other of the Board's areas. By 7:30 a. m., or within 2 hours of the incident, at least 50% of normal pressure had been restored to the low pressure zone; water was passing into the affected area at a rate of between 15 and 18 mgd.

This was, however, sufficient to give a supply to the lower areas only and about 350,000 people on the higher levels had no supply whatever.

Value of Interconnections Shown

Offers of supply in bulk were received from neighboring water authorities, who are connected to the Board's system, and about 2 mgd. was taken from the South Essex Water Company and a small amount from the Herts & Essex Water Company. At a later stage water was also taken into the Board's system at Merton Park, Surrey, at a rate of 5 mgd. from the Sutton & District Water Company, and the Croydon Corporation reduced their bulk supply takings from the Board by about 1 mgd.

Wartime Truck Tanks "Re-drafted"

During the war an emergency water supply scheme had been devised to supply water by means of tank wagons, and also to utilize private well supplies within the Board's area. Both these schemes were now disbanded and the Board had sold the majority of their 1,000 mobile tanks, each of which held 500 gallons. The purchaser of the tanks, however, had not completely removed them from the Board's works, 332 still remaining. These were immediately brought into use together with about 40 the Board had retained. Each tank had to be placed on a lorry and take the water round the streets for domestic use and also to supply essential services such as hospitals, bakeries, restaurants, etc.

All the available Board's trucks were brought into use and by 9:30 a. m. water was being supplied from tanks in the streets—see picture.

Urgent appeals for further transport were made to the Ministry of

"Shades of Hitler!"
These war emergency water distribution truck tanks (1,043 of them "re-drafted" into service to supply almost 1,000,000 people) reminded Londoners that Hitler at his worst could not do what the River Lea had done to their water supply.

Transport, to Local Authorities and the Board's contractors, the response being excellent, and on Sunday, March 16th, sufficient automotive equipment was available to carry all the tanks held by the Board.

The mobile tank supply operated throughout the hours of daylight only. By Sunday evening some 200 were in operation, the number being gradually stepped up, as further tanks and transport became available, to a total of 1,043 mobile tanks and tankers on Thursday evening, March 20th. They had a total capacity of 457,500 gallons.

Mutual-Aid

An appeal was sent to the War Office and the Air Ministry for the loan of tankers. On Monday, March 17th, they began to arrive and soon 400 were in service, together with service personnel. An appeal was also made to other water authorities for further 500-gallon tanks and these were provided by Sheffield — 99; Leeds — 78; and Bradford—32. They were transported by road, the drivers having to contend first with snow and ice, and then, as they neared London, with floods.

Some of the large hospitals and institutions were supplied with quantities of between 80,000 and 100,000 gallons per day by means of the mobile tanks and tankers. At one filling point on March 19th, 532 tanks were refilled from eight hydrants.

Mains Get Contaminated

The staff of the Water Examination Department commenced intensive sampling after the preliminary flood on Friday morning, March 14th, and the results showed that some contaminated water had got into supply and at noon on Saturday, March 15th, the British Broadcasting Corporation broadcast a warning to the public living in the affected areas that all water used for drinking and cooking purposes must be boiled. This warning was repeated at half-hourly intervals throughout the afternoon and, in addition, police cars patrolled the area and cinemas flashed the warning on the screen.

Remedial Measures

The flood had subsided sufficiently by noon on Sunday the 16th, to enable a survey to be made of the damage caused. The Chief Engineer held a conference and a plan was prepared to enable the works to be in commission again at the earliest moment.

At 3 p. m. on Sunday, pumping out the filter beds was commenced. One of the normal supply electric pumps was used, a section of the pumping-out mains isolated and a hole cut where it spans the river thus enabling the pump to clear the filter beds to waste. A very heavy dose of chlorine was administered to the water in the filter beds, possibly as high as 50 ppm. This was drawn through the sand under drains and culverts.

Pumping went on continuously at a rate of 10 to 12 mgd. concentrating first on beds Nos. 19-25 and, on Wednesday afternoon, it was possible for men to commence skimming the filth from the top of the filter sand. This was lifted from the beds by mobile cranes. The normal labor force was greatly increased and by 5 p. m. on Saturday, March 22nd, this set of beds had been cleaned and was being charged for use.

It was decided at the conference, in view of the risk of further flooding, to build a sand-bag dam across the aqueduct where it enters the works and also to raise the height of the existing flood banks round the works. The War Office was appealed to for help; they immediately responded and sent 500 men of the Coldstream and Scots Guards, together with the necessary equipment (see cover picture).* The wisdom of this extra precaution was evidenced by the fact that on the evening of Tuesday, March 18th, the water on the upstream side of the emergency sand-bag dam rose to a height of three feet higher than on the works side.

While filter cleaning was in progress the pumping machinery was examined and reconditioned, electric motors and control gear dried out, boiler flues pumped out, etc. Arrangements were also made to enable all units to pump to waste.

At 11 p. m. on Saturday, March 22nd, the "Musgrave" engine was started pumping to waste from filter beds Nos. 19-25 at a rate of 6 mgd., a chlorine dose of 10 ppm. being administered to the filter outlet conduits.

Hourly samples were collected by the sample collectors and at 4 a. m. on Monday, March 24th, the sample was pronounced first-class and water was again pumped into supply from Lea Bridge works.

The works were shut down completely from 6 a. m. Saturday, March 15th, to 4 a. m. Monday, March 24th. The supply from the works was then gradually increased until the works were in full commission again. When the works' output had been increased sufficiently to ensure that the reticulation of mains on the area was full, large numbers of samples were taken and on Thursday, March 27th, the Director of Water Examination announced that all danger from contaminated water was passed and the "boil water" warning withdrawn.

As may well be imagined, the rehabilitation of the works in a period of 9 days threw a heavy load on the staff of the Board, to which they loyally responded. Throughout the period, close contact was maintained with the Chairman of the Board and the Chairman of the Works and Stores Committee, who gave all the necessary authorizations immediately.

*There may be little in a name—but a fitting detail we should say, is the Coldstream Guards, sent in to check the charge of waters mostly formed from melting ice and snow.—L.H.E.

Westchester Water Works Conference Discusses Valves and Hydrants

At a regular meeting of the Westchester Water Works Conference held on March 25 in the town of Greenburgh, Westchester County, N. Y., 95 members and guests gathered to hear a discussion of the subject of valves and hydrants.

The meeting was presided over by the chairman, James C. Harding, Commissioner of Public Works for Westchester County. The principal speaker was Mr. James Carns of the American Water Works and Electric Co., who spoke on the subject of maintenance of valves and hydrants. Mr. Carns pointed out that faulty design and materials, deterioration, and neglect or abuse were listed as the principal causes of failure of such equipment.

Of particular interest was a demonstration of a device for lubricating valves invented by William Foster, Superintendent of the Peekskill Water Department.

The Westchester Water Works Conference, which was founded July 23, 1941 as a mutual aid war development, has grown into a lusty organization as evidenced by its membership and attendance.

Secretary of the Conference is R. M. McLaughlin, Director of the Westchester County Division of Sanitation, White Plains, N. Y.

ILLINOIS SECTION 38TH ANNUAL MEETING LARGEST YET

Two-Day Chicago Meeting Draws Record Attendance of 315

IN CHICAGO, the city of nine wonders of the modern world, according to W. W. DeBerard, City Engineer, who welcomed the

Chairmen

Incoming
S. T. Anderson
Gen. Supt. Water
Springfield, Ill.

Outgoing
John P. Harris
Ind. Chem. Sales
Chicago, Ill.

members, the 38th annual meeting of the Illinois Section of A.W.W.A. was the largest and most successful yet held. Three hundred and eighteen members and guests (183 actives, 81 manufacturers and 54 ladies) registered for the two day meeting to hear papers on atomic power, pensions, accidents, maintenance and operation, filter plants and wells.

Business Meeting

This being the annual meeting, new officers were elected for the ensuing year.

Chairman

S. T. Anderson, Gen. Supt.
Water, Light and Power Dept.
Springfield, Ill.

Vice Chairman

Horace R. Frye,
Supt., Water Dept.
Evanston, Ill.

Secretary-Treasurer

H. A. Tolburg, Ill. Representative
Neptune Meter Co.
Springfield, Ill.

Senior Trustee

J. C. Moomau, Mgr.
Northern Illinois Water Corp.
Sterling, Ill.

Junior Trustee

W. R. Gelston, Supt.
Water Works Com.
Quincy, Ill.

J. J. Woltman, Cons. Engr., Bloomington, continues as Director.

During the business session held at the end of the meeting, the secretary's report disclosed that the section now has 357 members, a gain of 28 in the past year.

Prof. Merrill B. Gamet of Northwestern University reported on the Northern Illinois Water Works Institute at Northwestern University, held last winter with a registration of 113 for the seven weekly meetings. The lecture papers were mimeographed and bound and may be obtained from Prof. Gamet for $1 a copy. A second institute will be held next winter.

Following a discussion of a licensing law, the section voted to support the passage of "An act to

Fuller Award
Clifford Fore
Supt. Wt'r & Sew.
Carbondale, Ill.

provide for safeguarding the public health by vesting certain measures of control and supervision in the Department of Public Health, over the operation of public water supplies, by a system of classifying water plant supplies and by examining, certifying, and regulating the persons in charge."

Fuller Award

The George Warren Fuller Awards as made each year by the sections of the Amer. Water Works Assn. are often presented for long time outstanding service to the water works profession. Seldom is a single outstanding service cited as the basis of the award, but this year in Illinois the award was made to **Clifford Fore,** Supt., Municipal Water Works and Sewage Treatment of Carbondale, for "service beyond the line of duty in rehabilitating the public water supply facilities of a neighboring community and restoring service after the water supply was entirely off for a considerable period of time."

Although Mr. Fore's service to

Vice Chairman
Horace R. Frye
Supt. of Water
Evanston, Ill.

Sec'y.-Treas.
H. A. Tolburg
Neptune Meter
Springfield, Ill.

his profession has been of deserving praise for many years, it is obvious that his work in this particular instance should be rewarded, and only lack of space here prevents repeating in full the complete story of that service as it was recounted in the announcement of the award.

Atomic Power

The first technical session was presided over by Chairman **John P. Harris,** Industrial Chemical Sales Div., Chicago, who presented **Prof. Milton Burton,** of the University of Notre Dame. Prof. Burton, who was Chief of the Radiation Laboratories at Oak Ridge, Tenn., during the war, spoke on "Atomic Power and Its Implications for Industry." In the course of his review of the history of atomic fission and power, Prof. Burton told for the first time the fact that at the Hanneford, Wash., plant on the Columbia River there is the world's largest demineralization plant, large enough to demineralize the entire water supply of a city the size of Baltimore.

Atomic plants may be one of three kinds—a producer of fissionable material, a producer of fissionable material and power, or a user of fissionable material. At present one of the limitations of atomic power is the necessary shielding from deadly radiations. Therefore, mobile power plants do not appear likely, except possibly in ships. Atomic power won't supplant coal,

gas, oil, or water at the present cost of $10 per ton for coal.

Prof. Burton expects Canada, now building an atomic power plant, and England to both have plants within three years. An experimental plant is now in construction at Oak Ridge. In 10 years there will probably be several plants in existence.

Illinois Water Supplies

Louis R. Howson, Consulting Engineer of Alvord, Burdick and Howson, Chicago, and this year's winner

Trustees

Senior	Junior
J. C. Moomau	*W. R. Gelston*
Mgr. North Wt'r Co.	*Supt. of Water*
Sterling, Ill.	*Quincy, Ill.*

of the John M. Goodell Prize for his paper, "Guides and Checks on Water Works Operation," presented a paper on "The Illinois Water Supplies—Past, Present, and Future." At the present time there are 700 Illinois communities which have public water supplies, serving 6½ million people. Most of these supplies have been built since 1840, when the first water works was started in Chicago. The second important water supply in Illinois was started in Springfield in 1866 with the water being taken from the Sangamon River. The only other important supply before 1870 was at Peoria, where the city constructed a plant in 1866 to take water from the Illinois River.

A number of other large cities started water systems after the war between the states; Decatur from filter beds in the Sangamon River in 1870, Quincy from the Mississippi River in 1873, and Rockford from deep wells in 1874, and Rock Island from the Mississippi River in 1870.

By 1897 there were 200 supplies in Illinois, 81 per cent of which were ground water and 19 per cent surface supplies. At the turn of the century there were 267 municipal water supplies, of which 77 per cent were ground water sources. By 1938 there were 625 water supplies of which 81 per cent used ground water, and in 1947 there are approximately 700 supplies of which 67 per cent have ground water sources.

Although ground water predominates in number of sources, it is observed that between 1910 and 1940 the number of consumers using ground waters increased but 5 per cent while the number of consumers using surface water increased 75 per cent.

Mr. Howson discussed factors governing the selection of a supply, taking into account such items as adequacy of supply, pollution, cost of construction, etc., and pointed out that in the northern half of the state few areas are limited to consideration of but one source of supply. An analysis of the needs of the community, past, present and future, is essential to the proper choice of supply.

Mr. Howson said that "it is almost axiomatic that any municipality which does not provide for its water supply requirements in advance of its needs is habitually unable to meet those demands as they arise."

On the matter of the behavior of underground supplies, Mr. Howson said that impressions that ground waters were generally failing in Illinois is not true; such impressions had been created by the difficulties of withdrawing increasingly large quantities of ground water in a few areas, particularly near Kankakee, Peoria, and Champaign - Urbana. As to the future, Mr. Howson told his audience that, "There are ample water resources in Illinois; the problem is how best to select them and develop them in the public interest," concluded Mr. Howson.

The A.W.W.A. and Water Works

Addressing the luncheon meeting, **N. T. Veatch,** Cons. Engr., Kansas City, Mo. and Vice President of A. W.W.A., reviewed for his listeners, the extent of the water works industry in comparison with other industries. Mr. Veatch emphasized the necessity for good public relations, and an adequate presentation of the service of a water utility to the community. In this regard, said Mr. Veatch, the American Water Works Assn. can be and is a big help through its public relations program and its many other services.

Pensions

"The Municipal & Utility Pension Act" was discussed by **H. S. Merz,** Supt., Water Dept., Rockford, Ill. Mr. Merz said that pensions in municipal water utilities are possible under the Illinois law, and may be voted by any city. At the present time there is some agitation in the state to place the utility pension system under the general municipal pension system, but without that possible change water works employees can now have a retirement and pension plan. Mr. Merz recommends that municipalities set up such retirement plans for water works men because they do not now come under social security, and a pension plan of their own improves morale greatly.

A.W.W.A.

Vice-Pres.	Ill. Director
N. T. Veatch	*J. J. Woltman*
Cons. Engr.	*Cons. Engr.*
Kansas City, Mo.	*Bloomington, Ill.*

The subject of changes in the state pension plans was discussed by **A. S. Hanson,** Consulting Actuary, Chicago, who had helped to draft the original plan. These changes have to do with credit for prior service, limit of salary base, age of retirement, and service disability. It may be expected that the two pension plans will be merged at some time in the future but when may not be foretold at the moment. Meanwhile municipalities should not wait, according to Mr. Hanson.

Salaries

Reading the paper by **W. H. Trentlage,** Commissioner of Public Property, Elgin, Ill., **LaVerne Trentlage,** Supt. of Water, Elgin, compared salaries of Water Works to Private Industry. The gist of Mr. Trentlage's argument was that from a practical standpoint water works men should consider non-money wages as well as actual monies received. Men want more than money and a municipal utility can give them self-respect, opportunity for self expression, recognition, comfort, the satisfaction of following a good leader, the feeling of progress, and friendly relations. These advantages when coupled with a sound dollar wage will compete with private industry for labor. If the utility hires smart ef-

ficient men, provides all of the above non-money wages and an adequate living wage and develops teamwork, it will benefit in its efficiency of operation and production.

Welcome
W. W. De Berard
City Engr.
Chicago, Ill.

Ill. Waters
L. R. Howson
Cons. Engr.
Chicago, Ill.

Accidents

An accident is a happening without design; it is not limited to damages or injury but may be costly whether or not personal harm occurs according to **H. F. Webb,** Gen. Safety Director, Amer. Water Works and Electric Co., Pittsburgh, Pa. Investigation of accidents that have happened are as important as accident prevention because such investigation may prevent future accidents. No accident can happen unless there is an unsafe act of an individual or a physical hazard. Men are thoughtless, sometimes reckless, but are never really careless. Two of the most important factors in accidents are environment and human behavior. Mr. Webb mentioned several accidents typical in the water works business; for example, a trench cave-in, a caulking explosion, a strained back from lifting heavy chemical sacks, eye injuries, falls into open tanks. As to what to do about accidents, Mr. Webb says, "organize for safety, tighten up supervision, provide safety devices, eliminate physical hazards, and train men in safe practices."

H. H. Gerstein, Chief Filtration Chemist, South Filtration Plant, Chicago, Ill., proposed that employees should be educated by in-service training, and pointed out that some employees have an inaptitude for certain jobs, always doing them inexpertly and subject to accident. Such men should be trained and used in jobs for which they have some ability.

PLANT MAINTENANCE, OPERATION AND DISTRIBUTION

Under the leadership of **C. C. Larson,** Supt. Lakeside Filter Plant, Springfield, Ill., a round table session covered wells and mains, filter plants, meters, elevated tanks, and chlorinating equipment.

Wm. Hutchins, Supt. Water Dept., Freeport, Ill., led off the comments on distribution systems and mains with a question as to how to prevent explosions when pouring a lead joint. The answers were: Keep water out of the joint; use rosin; and pour a little kerosene in the joint. No explanations of how rosin or kerosene act was forthcoming.

On the matter of sterilizing mains, the proposed A.W.W.A. committee method was discussed, as was the difficulty of sterilizing jute by chlorination. In one city, lime is used to sterilize jute, and in another autoclaving is used. Rubber joints are easily sterilized.

A. E. Anderson, Supt. of Water, Moline, Ill., introduced the subject of filter plants, turbidity, alkalinity and size of filter sand. As to low

Salaries

L. Trentlage
Supt. Meter Div.
Elgin, Ill.

*John A. Goetz**
Supt. Water Com.
Mattoon, Ill.

alkalinities of softened waters, **Dr. T. E. Larson,** Chemist, Illinois State Water Survey, stated that there is a range of 60 to 140 ppm. of alkalinity where the pH can be easily adjusted to prevent red water or deposition of calcium carbonate.

Effective sizes of sand seem to be going up. An average of 0.8 is being used now where 0.45 was formerly used, and at Springfield in the water softening plant the sand has reached an effective size of 1.43 without showing any decrease in efficiency of filtration while filter runs have increased.

Marshall S. Dutton, Commissioner, Village of Oak Park, Ill., opened the subject of meters and meter replacement. In his village, replacement is made when the cost of repair parts reaches $2.50. As to metering fire flows, in one city no meters are used, in another the detector meter is used, and in another city fire meters are being installed where it has been found that illegal taking of water has been practiced.

"Ed" Alt, Representative of the Chicago Bridge and Iron Co., answered questions on elevated stor-

Pensions
H. S. Merz
Supt. of Water
Rockford, Ill.

Accidents
H. H. Gerstein
Ch. Filt. Chem.
Chicago, Ill.

age. When considering welded tanks versus riveted tanks, there is a limit below which the welded tank cannot compete; this limit is approximately 100,000 gallons. Mr. Alt gave a rule of thumb table for estimating the cost of elevated tanks as follows:

Capacity, gals.	Cost per gal.
50,000	30c
100,000	25c
200,000	20c
300,000	17c
500,000	16c
1,000,000	14c

Aluminum roofs are still experimental, according to Mr. Alt, but cathodic protection has passed the experimental stage. **Frank McDonald,** Gen. Sales Mgr. for Electro-Rustproofing, said that "cathodic protection correctly designed and installed does the job for which it was designed," but it needs watching, too, to make sure that it is operating correctly.

C. C. Abplanalp, Dist. Mgr., Wallace & Tiernan, Chicago, answered questions on the operation of chlorinators. To eliminate chlorine ice, keep the tray water above 40 degrees; a Chromolox heater serves very well. To remove scale on floats, etc., use carbon tetrachloride or acetone with care. Graphite grease polished on these hard rubber parts will keep down deposition of scale. Flake graphite has been used successfully for the same purpose. To keep orifice tubes sparkling, one operator cleans them with acid and then washes them in Dreft.

FILTER PLANT SECTION

Presided over by **H. R. Frye,** Supt., Water Dept., Evanston, Ill., one section of the meeting was devoted to the discussion of problems of filter plant management and operation.

(*Just as we were going to press we were notified of the sudden death of Mr. Goetz on April 26, 1947.)

Taste and Odor Control

It was both fitting and proper that the first paper on this part of the program was by **John R. Baylis,** Engineer of Water Purification, Dept. of Public Works, Chicago, Ill. Mr. Baylis, who is an Editorial Associate of *Water & Sewage Works,* spoke on "Odor Removal at Chicago's South District Filtration Plant." Inasmuch as that part of the plant's operations had not yet gone into service, the technical paper was confined to a description of the proposed operations of odor removal. Until such time as all of the filters are completed and other equipment installed, complete operations for odor removal will not be possible.

Chicago's water supply odors come from two sources: Microscopic organisms and industrial wastes. The former are generally seasonal and of short duration, but other odors, perhaps less intense, last throughout the year, and odors from oil refinery wastes and other industries occasionally are severe. Phenol tastes and odors practically no longer exist since improvements in disposal of by-product coke oven wastes were made a number of years ago.

Prior to the war, when the Dunne Crib was in use, data for several years indicated that water from that source had a yearly average threshold odor value averaging from 2.0 to 8.0 with the average in some months running up to 14.6. Maximum daily threshold odor values were as high as 25 on individual days. It has also been observed that these threshold odors increase after chlorination by as much as one point.

Experimental work on the removal of odors was begun in Chicago in 1928 following a severe chlorphenol taste period in the winter of 1927-28. So bad was the water at that time that one company using the water for preparation of foods estimated their loss at $30,000, and tea, coffee and foods cooked in the water had to be thrown away. In the succeeding years the experimental studies were made on all the then known methods of odor removal at the Chicago Experimental Filter Plant. This work constituted the first attempt to use activated carbon in the treatment of municipal water supplies. It was found that activated carbon was the most efficacious treatment for this particular supply.

Experimental work showed that no definite relation exists between odor removed and carbon dosage for two apparent reasons. First, odor compounds are adsorbed in varying amounts by activated carbon, and secondly, the concentration of a chemical compound required to produce a given threshold odor varies.

Mr. Baylis said that the only means of determining the carbon dosage is the actual trial on a particular water to be treated. Experimental determinations of the dosage in the laboratory are helpful but are not always indicative of the plant results that will be obtained.

In addition to discussing the experimental studies of activated carbon for odor removal, Mr. Baylis showed slides of the design of the South District Water Filtration Plant in Chicago, and explained how activated carbon is to be handled at that plant. Two methods for handling the activated carbon are to be available. Equipment for storing and handling dry carbon in bags will be available and a method for handling bulk carbon direct from railroad car to slurry tank will also be tried. If the latter method works, it will eliminate problems of dusting. Nine carbon feeding machines are included in the equipment. Each machine has a feeding capacity of 600 lb. per hour. Alarms on the feeders will show when the machine is off from normal operation by five per cent or more. If the wet slurry method of handling is used, the carbon will be fed from a small head tank. This method has not been tried before and only a part of the equipment will be installed until test runs are made.

Specifications for activated carbon for the new Chicago Filtration Plant require that it must have a phenol coefficient of no more than 21 on the average with no single car to have a phenol number of more than 23. A penalty clause is to be invoked if specifications are not met. Approximately 1600 tons of carbon are to be used each year and storage space is provided for an ample supply. Tests on the carbon are to be made in the laboratory of the Filtration plant. The phenol value is the number of parts per million of carbon required to reduce the phenol in water from 0.1 ppm. to 0.01 ppm. in a one hour period of stirring.

Panel Discussion

Leader	Filters	Chlorinators	Elev. Tanks
C. C. Larson	*A. E. Anderson*	*C. C. Abplanalp*	*Edw. E. Alt*
Supt. Filt. Plant	*Supt. of Water*	*W. & T.*	*Chi. Bridge & Iron*
Springfield, Ill.	*Moline, Ill.*	*Chicago, Ill.*	*Chicago, Ill.*

[Present but not "Kodaked"—Wm. Hutchins, Supt., Freeport (Mains), and Marshall S. Dutton, Comm., Oak Park (Meters)]

Management of Water Utilities

Under the title, "Municipal Water Works Organizations in Illinois," **W. R. Gelston,** Superintendent, Water Works Comm., Quincy, Ill., reported on the results of a questionnaire seeking to determine the type of top management best suited to water works in Illinois.

Mr. Gelston's paper was in reality a report as a member of the A.W.W.A. Committee on Municipal Water Works Organization and dealt solely with the State of Illinois, although Mr. Gelston himself has been handling the questionnaires in both Illinois and Indiana. This committee was organized to study existing state laws and municipal ordinances, and to formulate principles relating to forms of management of municipal water works systems.

Thirty questionnaires were returned from Illinois, and it was interesting to note that only one (Chicago) mentioned that operation was under any Illinois state law, while 80 per cent of the replies from Indiana not only mentioned operation under state laws but gave the number and section of the law. Obviously, Illinois is a home

rule state and thinks of operation at the local level, even though there are certain state statutes which establish this theory of home rule. For example, it is possible by local election to provide that a water works shall operate under a water district, a joint water district with other municipalities, a commission form, etc.

Where separate boards or commissions now exist, all persons replying stated that it was the best system. Where city water departments now exist, 50 per cent believe that type of management is best suited to the needs of the municipality and the other 50 per cent believe another form would be best.

All persons replying to the questionnaire agreed that they did not want state supervision except in the matter of operator licensing, and all wanted less political interference with operation of the plant. Diversion of funds seems to work without difficulty in some places but not in others.

Taste and Odor

John R. Baylis
Phys. Chem.
Bur. of Engr.
Chicago, Ill.

Water Anal.

James Weart
Engineer
Ill. Bd. Health
Springfield, Ill.

Mr. Gelston pointed out that under the law an Illinois community could have any type of management it desired and that therefore if persons wanted a change in type of management, they should educate the public.

During the discussion period, **Arthur Kuranz,** Supt. of the Waukesha, Wis., Utility, explained the operation of water utilities in Wisconsin under the Public Utilities Commission. Wisconsin utilities give no free water, pay taxes as does any utility, have no diversion of funds, can issue revenue bonds, must have a standard accounting system, but do have some measure of home rule. Mr. Kuranz believes in this system but says that in Illinois it is still possible for a water department to function properly and that it is up to the individual man to see that his system does work.

Water Analysis Methods

Speaking on "New Angles in Water Analysis," **James Weart,** Engineer, Illinois State Board of Health, Springfield, commented on the 9th Edition of Standard Methods for the Examination of Water and Sewage. Mr. Weart notes an increase in the use of instrumental methods and apparatus; he also notes the value of referee committees in the development of analytical methods. In reference to the latter point the speaker cited the methods for residual chlorine and fluorides.

Mr. Weart had a number of comments to make on new methods which he believes should be considered for the next edition of this standard work. These items include the following:

1. Use of sodium borate instead of sodium carbonate in the standardization of sulfuric acid.

2. In the gravimetric determination of calcium, ignition for one hour at 500 deg. C. to produce the carbonate instead of the oxide.

3. In the volumetric determination of calcium, the use of ceric sulfate as the reagent instead of potassium permanganate.

4. In the test for nitrates, eliminate the use of fuming sulfuric acid.

5. Use of perchloric acid instead of hydrochloric acid in the acid solution of samples.

6. Use of crystalline indicators for pH reagent solutions.

Mr. Weart strongly favors the use of lauryl sulfate broth as a primary planting medium for the coliform determination, and he believes that brilliant green bile broth is preferable to E.M.B. or Endo media for partial confirmation.

One important factor in water analysis is the purity of the distilled water. It must be free from copper, iron, ammonia, chlorine, sulfate, and alkalinity, particularly when used for those tests. Water from an ion demineralization unit contains carbon dioxide and silica, and may contain fluorides under certain conditions of operation.

The ortho-tolidine arsenite test for combined and free residual chlorine is only approximate and the only true result may be obtained by the new amperometric titrator now on the market.

WELLS SECTION

(Reported by Dr. T. E. Larson, Chemist, Ill. State Water Survey)

J. C. Moomau, Manager, Northern Illinois Water Corp., Sterling, Ill., presided at the section on "Wells" on Friday morning. At this session, **Dr. A. M. Buswell,** Chief of the Illinois State Water Survey, stated that there is practically as much water in the artesian aquifers in Illinois today as there was when Columbus discovered America, but the pertinent point in question was not the quantity of water stored but nature's ability to deliver that water to the desired point. This is the critical factor in determining whether exhaustion was taking place or accessibility was decreasing and

Wells

A. M. Buswell
Chief, Illinois
State Water Sur.
Urbana, Ill.

Carl Duy
Supt. of Water
Aurora, Ill.

was the theme of the topic of "Future of Well Supply" as presented by Dr. Buswell.

Records!

Specific facts on ground waters were illustrated by 10 slides indicating the history of ground water conditions in Illinois and indicating the several types of work being carried on by the Illinois State Water Survey. Much emphasis was placed on the need for the regular collection of data on pumpage and water levels and *the desirability for records* by the owners of well supplies themselves.

It was indicated that ground water resources are still adequate for continued uses, but local over-development of these resources frequently leads to rapid recession of water levels and embarrassing shortages. Ground water use in Illinois has a good future if kept available for the uses for which it is ideally suited. One such use is for cooling purposes. Developing surface waters to a greater extent can halt and reverse the ground water retreat, thereby preserving ground water for its best

use. Disorderly exploitation will drive ground water pressures so far beneath the surface that they will become useless to all. In turn, relieving the local heavy demands on ground waters will bring about more use of wells. The use of recharge techniques will bring about the construction of more wells. Thoughtful ground water development facilitates greater ground water use.

Experiences in Illinois show that existing statutes are not adequate for orderly and economical development of ground water resources. Lack of legislation facilitating the use of Lake Michigan water for the communities surrounding Chicago has added to the over-development of ground water supplies.

Carl Duy, Superintendent of the Aurora Water Department, corroborated Dr. Buswell's report and indicated that dependable pumping machinery is available for delivering water from the present 400 and 500-foot water levels to the ground surface or above at a very reasonable cost per thousand gallons. Mr. Duy was of the opinion that a dependable supply of well water can be obtained for a considerable length of time, and that dependable equipment may be designed to deliver water from pumping levels below 600 feet. Objection was raised concerning the verbal use of misleading information and the unjustified comparison of wells in the same city or in different cities. Such comparisons should be accompanied by a complete discussion on the physical design and description of the wells.

Records!!

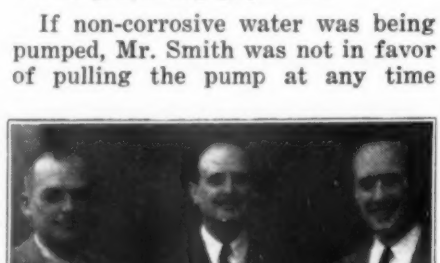
The value of frequent observations on water levels and pumpage records was again pointed out. Consistent records aid in the prevention of troubles due to the loss of production and oftentimes financial loss in power and machinery. Mr. Duy has been keeping such records at Aurora for six years with a great deal of success.

"Maintenance of Wells and Deep Well Pumps" was the subject of a paper presented by **Edwin Smith,** District Engineer for Layne-Western Co. in St. Louis. Mr. Smith's discussion was "jam-packed" with specific do's and don'ts with regard to mechanical maintenance of turbine pumps.

Records!!!

Great emphasis was again placed on the value of frequent continuous operating records. Each well should have a complete historical record containing information on the log and construction features, the production test data, water analysis, specifications of pumping equipment and such records as are available on other wells in the surrounding vicinity. Monthly summaries should show the static water level, pumping level, pumping capacity, discharge pressure and power consumption. It is not enough to know that production is decreasing or that the power bill has gone up unless the other factors are available to point toward the general location of the trouble. These records are to the water works man what the thermometer, the stethoscope and the reflex mallet are to the practicing physician.

If non-corrosive water was being pumped, Mr. Smith was not in favor of pulling the pump at any time other than when it became a necessity. Worn pump parts require replacement and when worn badly enough will make themselves known at the surface providing continuous records are maintained. When corrosive water is used, however, it is good practice to remove the pump periodically for inspection before the column pipe and tubing become too greatly weakened by the corrosive action.



W.P.A. Entertainment Committee

Tom Storms, R. D. Wood Co., Chicago
Lindy Harper, Omega Mach. Co., Chicago
Carl Brown, U. S. Pipe & Fdy., Chicago
(Missing in snapshot—George White, Mueller Co., Decatur)

For such water it is good economy to spend more on the pump installation to reduce the frequency of the visual inspection by pulling the pump. Mr. Smith warned that repairing a vertical turbine pump was a ticklish job since it is a carefully built piece of machinery and operates as successfully as it does because of the care taken in its fabrication. The methods of well rehabilitation by means of impact, surging, scrubbing and chemical treatment were discussed. In a good many instances it has been shown that the deposition of incrustants occurs on the screen and in the gravel pack whether artificial or developed but seldom to any extent into the native formation.

G. N. Andrews, Manager of the Utilities Department, Shell Oil Co., Wood River, Illinois, presented an able discussion on "Well Cleaning". Of the fifty-one 120-foot wells drilled in gravel for the Shell Oil Co. at Wood River, only 20 are now in operation and producing the required 3½ million gallons per day. Before applying chemical treatment these wells decreased in capacity to the extent of approximately 2 per cent per month. Since the development of chemical treatment and its introduction on a regular schedule and by reducing the pumpage from each of the wells no decrease in capacity has been noted for the past two years. The wells are spaced some 350 to 500 feet apart. They are constructed with Thorpe porous concrete screens having a 30-in. id. and 40-in. od. The porosity of the concrete is approximately 30 per cent. These wells are operated at a rate of 400 to 450 gpm. with a 5-foot drawdown, and designed to pump 1 gpm. per sq. ft. of outside screen surface. The average static water level is at 62 feet.

Records!!!!

The desirability of operating records was again emphasized for these wells are treated one or two times a year according to the pumpage and water level records. A total of 270 lb. of calgon, 30 lb. of soda ash and 30 lb. of pentaclorphenate in 5 doses over a period of 5 or 6 days. During this period these wells are surged several times daily. By reducing pumpage from individual wells Mr. Andrews has eliminated the tendency for clogging by pulling in fine sand thereby permitting a satisfactory recovery in capacity by chemical treatment. This treatment has improved the specific capacity by decreasing the drawdown by 15 feet and even as much as 26 feet.

This paper was remarkable because of the intelligent approach to the well operation and maintenance problem. The speaker pointed out the value of operating wells according to the formation in which water is being pumped and treating the wells periodically rather than permitting degeneration to take place to such an extent that drastic treatment be required in order that treatment have any hope of being successful.

UP-SEWER CLOROBEN TREATMENT OF LOS ANGELES SEWAGE

Reduces Coliform Bacteria and Inhibits H_2S Formation

By REUBEN F. BROWN
Superintendent
SEWER MAINTENANCE AND OPERATION
LOS ANGELES, CALIF.

IN a previous article, presented before the California Sewage Works Assn. in June 1946, the writer first disclosed the experimental work on the treatment of Los Angeles sewage with the chlorinated hydrocarbon, "Cloroben." Since that time additional information has become available as the result of extended studies. This article reviews the overall experimental observations resulting from the use of Cloroben to reduce coliform bacteria and to inhibit the formation of malodorous and destructive hydrogen sulfide in the sewage. A brief review of the situation in Los Angeles will be helpful to the presentation.

The city of Los Angeles, and a number of surrounding communities under contract to the city, collect their wastes in a 3000 mile sewer system and discharge these combined wastes (both domestic and industrial) into the Pacific Ocean through an outfall at Hyperion. The average daily flow is 165,000,000 mil. gal. and the maximum discharge is 200 mgd.

With this quantity of waste entering the ocean daily, the surrounding waters have become grossly polluted resulting in the quarantine of beaches for miles along the ocean front. Because of this pollution, the California State Board of Health brought suit against the City of Los Angeles, which was ordered to reduce the bacterial content of the sewage before it was introduced into the ocean. June 1, 1946 was set as the date by which the extremities of the beaches were to be free of pollution.

The court's decision required that bacterial contamination of bathing beaches, embracing the most valuable and crowded recreational areas of Santa Monica Bay, be brought down to permissible limits, either by chlorination at Hyperion or by other means. Examination of beach pollution charts for 1945 indicated that if the coliform density of the sewage discharged at Hyperion was reduced by 50 per cent, the coliform bacteria reaching the beaches would be reduced by an equivalent amount, thus justifying the lifting of the beach quarantine at the extremities of the polluted areas.

The Author
(As he appeared on a photographic inspection trip through the hazardous gas laden Los Angeles trunk sewers in a skiff. Dubbed by us at the time— "Dare-Devil" Brown.)

Studies had indicated the chlorine demand of the sewage at Hyperion to be nearly 30 ppm. with an industrial waste shock-load sometimes boosting the demand to 92 ppm. To satisfy that chlorine demand would cost approximately $2000 per day for chlorine, and peak summer loads might be as much as 25 per cent higher. Obviously such costly treatment was out of the question. The alternative was to find some less expensive treatment, and experimental work was directed toward this objective.

In addition to these studies, investigations were also directed toward ascertaining the effect of industrial waste on beach pollution and the effect of such wastes on trunk sewer flows, pipe line structures, and plant maintenance and operation. Inasmuch as industrial wastes account for 30 per cent of the daily sewage flow, and heavy greases and oil cause large slick fields on the ocean, studies to reduce and control these wastes were made a part of the program.

Typical Quarantine Sign Erected by The Calif. Health Dept.

A third problem was also under consideration at the time of these studies. It had been found that some industrial wastes discharging into storm drains, ditches, channels, and water courses, were polluting ground water supplies and some domestic wells had to be abandoned. To prevent such ground water pollution it appeared that these wastes would have to be taken into the sewer system. It was therefore desirable to know what effect such wastes would have on the sewers and on beach pollution.

Program of Study

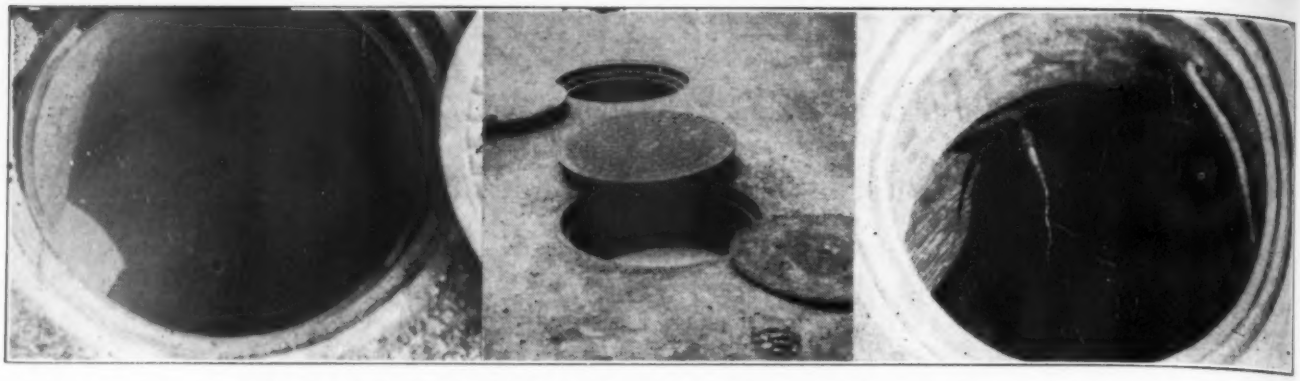
The field work was carried on by the Sewer Maintenance Division and the laboratory analyses and investigations were performed by the bacteriological section of the Bureau of Standards. All field work and laboratory analyses were on a seven day week and three eight hour shifts a day.

The laboratory work included analysis of all sewage and ocean water samples; research on various bactericides and combinations thereof; analysis of industrial wastes discharged into city sewers, drains and water courses; and determination of the effect of industrial wastes on trunk line sewers.

At the same time, the Sewer Maintenance Division was collecting samples for analysis, and dosing various sewers with chemicals for the control of bacterial growth in the sewage.

The program outlined for study before field operations were started included the following:

1. Find a suitable bactericide.
2. Measure lethal action of bactericide on coliform bacteria.



Specially Constructed Novel Under-Street-Surface; Dosing Station on Trunk Sewer
Left—Chemical tank holds 125 gallons. Note hole in bottom for discharge into adjacent sewer manhole.
Center—Revealing location of dosing station and manhole in background.
Right—Cloroben solution dripping into manhole from adjacent dosing tank.

3. Determine quantity of bactericide necessary to reduce bacteria by 50 per cent at Hyperion.
4. Determine most effective contact time.
5. Determine effect of bactericide on fresh and stale sewage at different temperatures.
6. Determine the inhibiting effect of the bactericide on hydrogen sulfide production.
7. Ascertain the best method of dosage.
8. Ascertain the effect of dilution by sea water on sewage treated with the chosen chemical.
9. Establish a method of testing the material as a basis of specification and purchase.
10. Determine the effect of pollution by storm water discharge on sea water.

In short the whole program was designed to find some chemical, combination of chemicals, or other method of treatment which would reduce the number of coliform organisms going into the ocean at Hyperion so that less than 10 coliform bacteria per ml. would appear on the beaches of Santa Monica Bay.

Previous Observations Give Lead

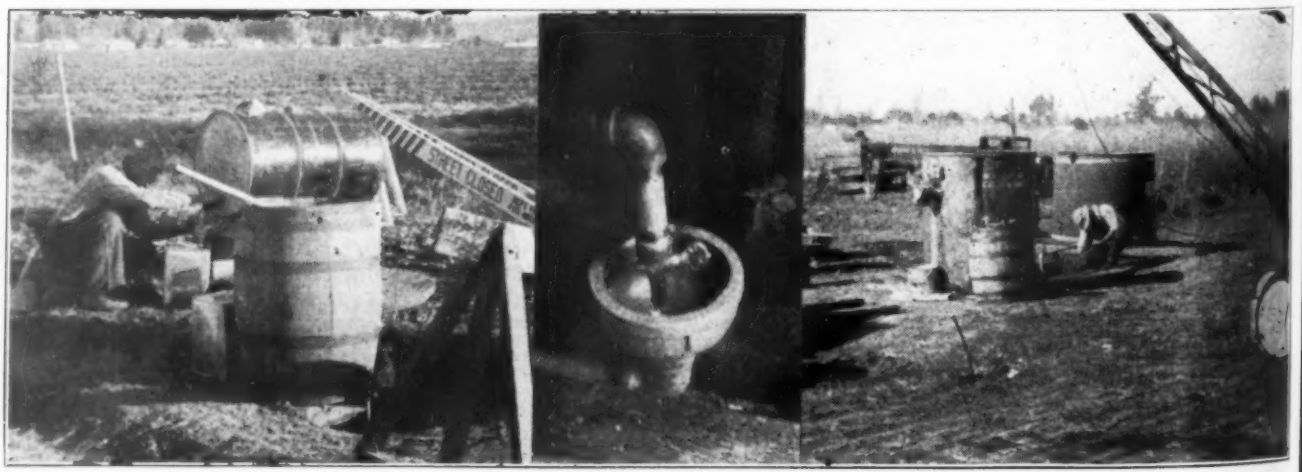
In the course of previous work by the Sewer Maintenance Division in its studies of odor, fly, and mosquito control, observations had been made on the efficacy of various chemical compounds. In some cases these observations were made in the prevention of health hazards due to sewer breaks or pipe line stoppages.

Among the chemicals used for these various purposes were copper sulfate commercial hypochlorites, bleaching powder, and a chlorinated hydrocarbon. In these observations it had been found that chlorine compounds were too costly when volumes greater than one million gallons had to be disinfected. The chlorinated hydrocarbon called "Cloroben" was found to be very effective in the control of odors and in the control of algae in some 350 miles of ditches and channels. By proper application of this material to storm drains, catch basins and culverts complaints against odors and mosquitoes were lessened to a marked degree. It was also found that a one per cent solution of Cloroben when applied to screenings eliminated the fly and mosquito problem at the disposal plant.

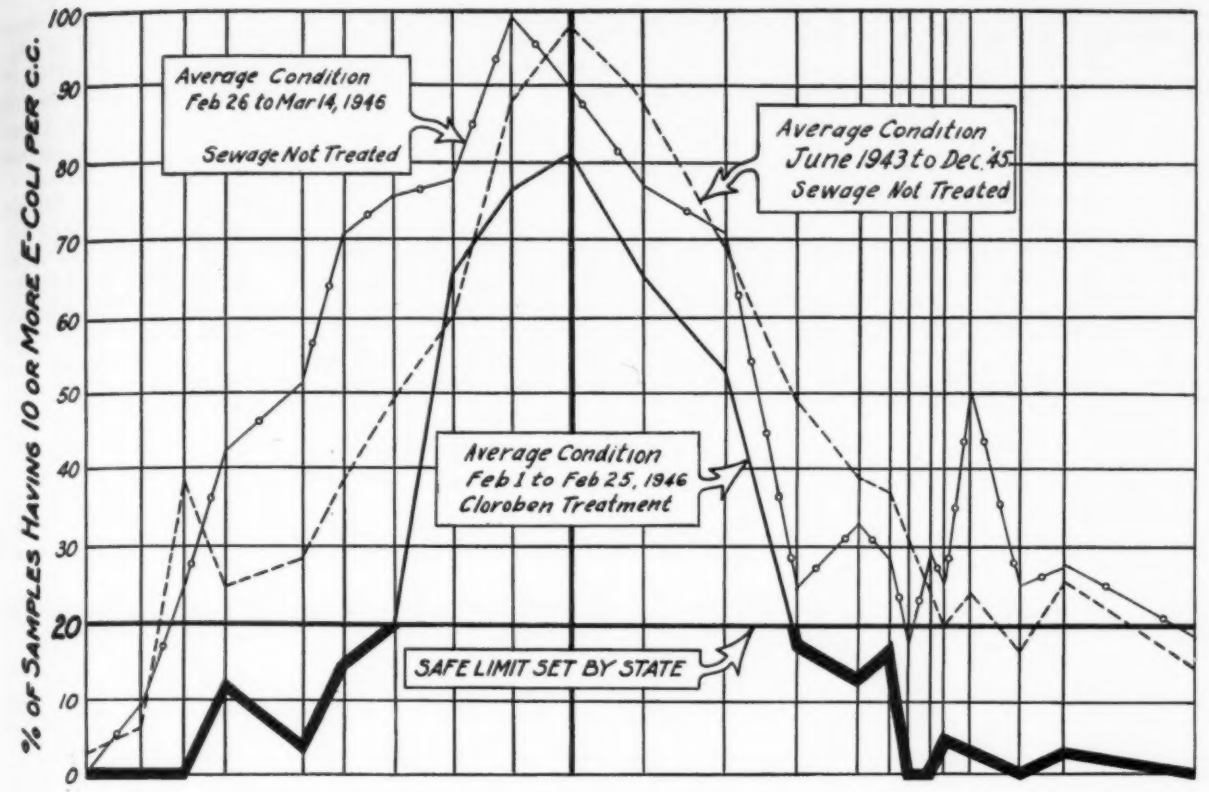
On one occasion when sewage was being diverted into a storm drain, the addition of from one to three gallons of Cloroben (in fifty gallons of water) to from one to two million gallons of sewage reduced the bacterial content of the sewage by 90 per cent and eliminated the odors usually attendant with such diversion operations. On the basis of these operations it appeared that laboratory studies on this chemical might prove valuable.

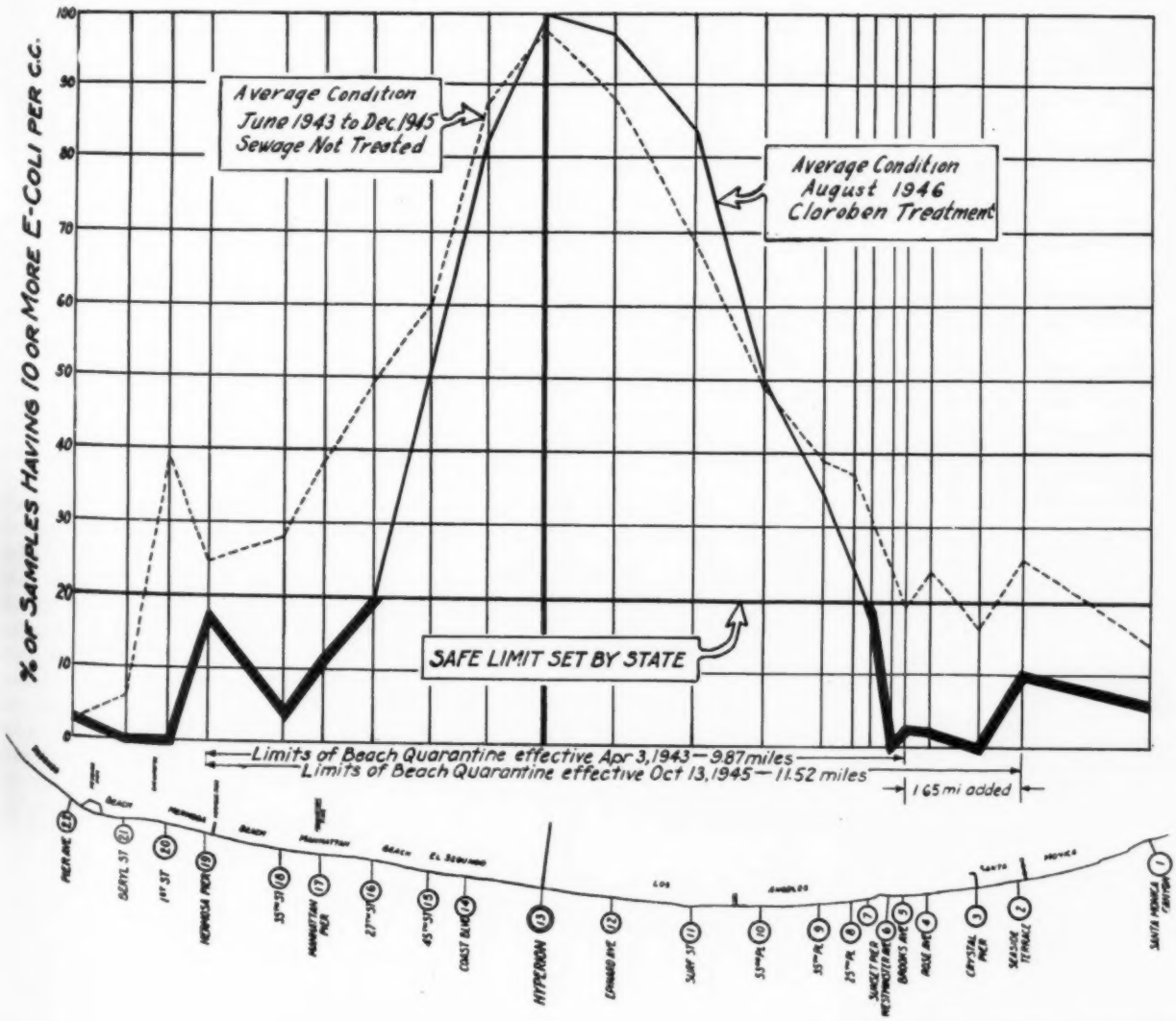
Laboratory Studies

Several bactericides were subjected to investigation separately and in combinations. These included bleaching powder, chlorine, DDT, salts of heavy metals, and several organic compounds including Cloroben.



Dosing Stations for Cloroben Treatment
Left—San Fernando Valley Outfall—First experimental field dosing station.
Center—Discharge valve at a dosing station. These valves were set to discharge at various rates of flow depending on quantity of sewage to be treated.
Right—Experiment at Jackson St. Siphon. 500 gallon tanks used to mix water and chemical. Three hour contact time from this point on sewer to outfall line.


% OF SAMPLES HAVING 10 OR MORE E-COLI PER C.C.
Average Condition
Feb 26 to Mar 14, 1946
Sewage Not Treated
Average Condition
June 1943 to Dec. '45
Sewage Not Treated
Average Condition
Feb 1 to Feb 25, 1946
Cloroben Treatment
SAFE LIMIT SET BY STATE


% OF SAMPLES HAVING 10 OR MORE E-COLI PER C.C.
Average Condition
June 1943 to Dec. 1945
Sewage Not Treated
Average Condition
August 1946
Cloroben Treatment
SAFE LIMIT SET BY STATE
Limits of Beach Quarantine effective Apr 3, 1943 — 9.87 miles
Limits of Beach Quarantine effective Oct 13, 1945 — 11.52 miles
1.65 mi added
HYPERION

Graphs Showing Conditions in Beach Waters Above—Data for Feb.-Mar. Below—Data for August

Jar tests indicated that, with proper contact period, Cloroben when applied in the ratio of one gallon to one million gallons of sewage (1 ppm. by volume) would reduce the coliform content by 90 per cent. On the basis of these tests a pilot test was made on a 20-mile sewer carrying approximately 10 mil. gal. a day. The chemical was dosed at the upper end of the sewer and samples were taken at the lower end. Results from these studies may be tabulated as follows:

Cloroben Dosage (ppm. by vol.)	% Reduction in Bacteria
1.0	50 to 90
1.5	90

A combination treatment consisting of one ppm. of Cloroben plus chlorine equal to but 20 per cent of the chlorine demand gave a bacterial reduction of 95 to 99 per cent. During these tests it was observed that sewage treated with Cloroben contained only 0.1 ppm. of hydrogen sulfide, whereas untreated sewage in the same line had contained from 5.0 to 10.0 ppm. of H_2S.

Full Scale Field Studies

The results of these laboratory and pilot test studies were so satisfactory that the entire sewer system was put under treatment. Forty dosing stations were put in operation (there are now more than 50 such stations) and samples were taken of the entire sewage flow at Hyperion as well as from twenty-two beach locations in the ocean.

Dosage stations consisted of clean wooden barrels of 30 or 50 gallon capacity set up at manholes on the upper end of trunk lines. The chemical was emulsified with water when the barrels were filled. Rate of application of the chemical was regulated by a cock in the bottom of the barrel. The dosage schedule was determined by the flow to be treated and varied as necessary according to the laboratory findings of effectiveness of treatment. Where heavy industrial wastes existed in the sewers, larger quantities of chemical were required for effective results.

On the basis of these full scale studies, it was possible to arrive at certain conclusions regarding the treatment. These conclusions may be simply stated as follows:

1. Proper distribution throughout the sewer system is essential to desired results.
2. Cloroben should be mixed with at least four times its own volume of water before using.
3. Mechanical or hand mixing of the chemical with the sewage does not increase the bacterial kill.
4. Sewage apparently has a "Cloroben-Demand" as bacterial kill varied from 50 to 90 per cent in fresh sewage and stale sewage required much greater dosage to obtain the same results.
5. The best results were obtained when a contact time of five to nine hours was available.
6. Bacterial reduction increased when Cloroben treated sewage was diluted with sea water (1 to 100 volumes) and allowed an additional three to five hour contact.
7. Laboratory data indicated that Cloroben had a bactericidal power thirteen times that of phenol.

Effect on Ocean and Beaches

"The proof of the pudding is in the eating" and obviously the final evaluation of this treatment of the sewage is dependent on the resulting conditions in the ocean and along the beaches.

The State of California has set a safe limit for coliform bacteria in the beach waters. This limit requires that no more than 20 per cent of the samples may have 10 or more coliform bacteria per ml. The accompanying graphs show to what extent the samples of the beach waters up shore and down shore from the Los Angeles outfall have exceeded this limit. The upper section shows observations for the period of Feb.-Mar. 1946, with and without Cloroben treatment; the lower section shows the results again in August 1946 when Cloroben treatment was in use under summer conditions.

In both parts of the chart the vertical lines represent sampling stations, the heavy vertical line representing the Hyperion Outlet. The dashed line representing bacterial conditions of beach waters represents the average condition of these waters as indicated by samples collected from June 1943 to Dec. 1945, when the sewage was not being treated. It will be noted that on the average, 97 per cent of the beach samples at Hyperion (Sta. 13) contain 10 or more coliform per ml. when the sewage is not treated. This concentration drops off fairly rapidly in both directions but does not fall below the safe limit for a distance of more than 13 miles. Of this 13 miles the State has quarantined 11.52 miles.

In the upper section of the graph, the solid line with circles represents samples collected in Feb. and Mar. when no Cloroben was used. The heavy solid line shows the results during the trial period of disinfection with Cloroben. It will be noted that only 80 per cent of the samples show 10 or more coliform per ml. and the pollution does not spread so far in either direction as when no treatment was used. As shown by the very heavy solid line the area between Station 2 and 10 (a distance of 3.65 miles) and the area between Station 16 and 19 (a distance of 2.37 miles) need not be quarantined because of the coliform content. This is a decided improvement, due obviously to treatment with Cloroben.

Analytical Work

Left—Making a total sulfide test in the field
Center—Equipment used in making tests for H_2S in the atmosphere.
Right—Testing a shipment of Cloroben for killing power and dispersion.

In the lower section of the graph the data for August shows that although 100 per cent of the beach water samples at the Hyperion Outlet contain 10 or more coliform per ml. the concentration drops off (when Cloroben is used) and the beach waters at both ends are within the safe limit set by the state. Thus at the north end (right hand side of chart), 2.15 miles need not be quarantined, and at the south end 2.37 miles of beach need not be quarantined.

From these results it appears obvious that when the sewage of Los Angeles is treated with Cloroben by up-sewer applications, the waters of the beaches are materially improved at the extremities of the areas normally polluted by the discharge from the Hyperion outfall.

EFFECT ON H_2S FORMATION

One of the most interesting results of the experimental program was to observe that as a result of the up-sewer treatment the formation of hydrogen sulfide was inhibited to a large degree. A number of years ago, studies on trunk sewer lines discharging into the outfall sewer, indicated that the hydrogen sulfide content of the sewage was as high as 25 ppm., in some sewers. Other sewers contained 1.5, 5.0, and even 10.0 ppm. of hydrogen sulfide. The outfall sewer at Hyperion contained an average of 2.25 ppm.

Studies in 1938-39 indicated that hydrogen sulfide in the atmosphere in a sewer was directly proportional to the sulfide content of the sewage; the concentration in the atmosphere usually roughly 0.5 per cent of that in the sewage. Not only did this hydrogen sulfide serve as a source of disagreeable odors but under the influence of bacteria, moisture and atmospheric oxygen, some of the hydrogen sulfide was converted to sulfuric acid with the result that deterioration of sewers, man holes and pipe lines occurred. In order to reduce these undesirable effects, a program of forced ventilation was instituted on the main sewers. Stack sewer air from this forced ventilation carried as high as 50 ppm. of H_2S but the atmosphere in the sewers was kept to a concentration of 0.1 ppm. of H_2S.

In view of this costly method of sewer protection and odor nuisance control it was a distinctly pleasant surprise to discover in the early pilot tests, that the use of approximately 1.0 ppm. of Cloroben also inhibited the formation of hydrogen sulfide. This action undoubtedly results from the effect of the chemical in checking the growth of organisms which produce hydrogen sulfide from sulfur bearing compounds in the sewage.

Truck Transported Drum of Chemical from Which Dosing Stations were Filled

When the full scale experimental dosage of the entire sewage flow was adopted it was found that the individual sewers contained from but a trace to 0.6 ppm. of hydrogen sulfide in the sewage and the sewage at the Hyperion outfall contained approximately 0.2 ppm. H_2S on the average (0.09 to 0.27 ppm.). Thus the hydrogen sulfide content of the total sewage flow at Hyperion had been reduced by 91.6 per cent.

It was observed at the same time that there were no heavy sewer gases and therefore the expensive ventilating system was shut down. Whereas the hydrogen sulfide content of the sewer atmosphere had been 15 to 17 ppm. in 1938 before ventilation, it was found that when Cloroben was used (even in July and August) the hydrogen sulfide content of the sewer atmosphere was but 1.93 ppm. even when there was no forced ventilation.

Effect on Sulfuric Acid Formation

In 1938, studies showed that the relative humidity of the atmosphere in the sewers was 100 per cent. Under that condition, the walls of the sewers were always damp and with so much hydrogen sulfide in the atmosphere there was always some production of sulfuric acid which cause a deterioration of sewers, pipe, joints and manholes.

Field Man Sampling Beach Waters

Observations made on one 12-ft. sewer and on the outfall, during the test period when Cloroben was being used on a citywide basis, showed that the relative humidity of the atmosphere in the outfall was only from 56 to 76 per cent, with a median of 71 per cent. In fact, there were but few points in the sewer where the relative humidity was higher than the outside atmosphere. It was also observed that the walls of the sewer above the flow line were relatively dry, and that the haze which accompanies high humidity was absent. At three different locations, blotting paper was hung in the sewer atmosphere. Some moisture was absorbed by the paper, but there was no determinable amount of sulfuric acid produced.

From these observations it would appear that with the inhibition of hydrogen sulfide formation there is also an unexplainable reduction in the relative humidity, both of which are factors in the formation of sulfuric acid and the deterioriation of concrete by sulfuric acid. Long time experiments are now under way to investigate these points further.

Storm Drains and Industrial Wastes

It was discovered during the studies that storm drains discharging onto bathing beaches carried from 50 to 5000 coliform organisms per ml. and that storm water discharges were as bad as sewage in affecting the bacterial quality of the beach waters. It was also found that during dry weather, high tides and very low tides caused increased bacteria counts in the surf at the outlet of the storm drain. Field operations were directed toward relieving this situation by the use of Cloroben in the storm sewers also.

Where industrial wastes are an important factor in sewage concentration, the dosage of Cloroben was higher than in ordinary domestic sewers. When shock industrial loads reach the disposal plant, they are given emergency treatment of chlorine. Peak load flows with chlorine demands of 65 to 92 ppm., 3000 ppm. of grease, and 500 to 900 ppm. of suspended solids are deserving of serious consideration. In consequence, a program to reduce these wastes is under way.

One other observation is of inter-

est. In one sewer after the sewage was treated with Cloroben for a time, the slime and side wall growth sloughed off and deposited in a siphon, stopped the flow and necessitated the by-passing of sewage. Additional quantities of Cloroben were added to the sewage at the rate of 5 gallons every 24 hours, and gradually the siphon opened up and flow was resumed without any hand or mechanical cleaning.

Summary and Conclusions

On the basis of these studies and observations, certain conclusions have been reached in regard to the use of Cloroben as a chemical for the treatment of sewage at up-sewer locations.

1. This chemical is not dangerous or difficult for the personnel to handle and its application does not require expensive or extensive equipment.

2. When this chemical is added in concentrations of approximately 1 to 2 ppm. in up-sewer locations, and allowed a long contact time in the sewers, the sewage reaching the outfall has its bacterial population reduced by 50 per cent or more.

3. Apparently because of the bactericidal action of this chemical, organisms which produce hydrogen sulfide are either killed or otherwise interfered with so that hydrogen sulfide production in long trunk sewers is reduced by 65 to 95 per cent.

4. With this inhibitory effect on hydrogen sulfide formation goes the other benefits of less odor, and the minimizing of the production of sulfuric acid and its consequent deteriorating effects on sewers.

5. In Los Angeles, not only were the ocean beach waters improved as the result of this chemical treatment, but the lack of hydrogen sulfide made it possible to eliminate forced ventilation of the sewers.

6. On the basis of these studies it appears that by the use of this chemical in up-sewer locations in Los Angeles the desired conditions in the ocean may be reached without chlorination or with but approximately 20 per cent chlorination at a savings of approximately $1200 per day for the five month summer period when a court order specifies that treatment to reduce the bacterial index of beach waters be employed.

7. Certain observations made during the studies indicate that during treatment of the sewage with this chemical, the humidity of the sewer atmosphere is seldom above outside humidity, and that sulfuric acid formation is practically absent. These observations indicate benefits to be derived in longer life and less maintenance of sewers and sewer structures.

8. It has also been observed that when this chemical is added to the sewage there is a tendency to dissolve greases and slimes.

9. This method of treatment will be continued and further studies and observations on the efficacy of the treatment will be made.

Acknowledgment

The investigative and experimental work was under the direction of H. P. Cortelyou, Engineer-Director of the Bureau of Maintenance and Sanitation. The field work was under the supervision of the writer, and the laboratory analyses and research under the supervision of John T. Young, Director of the Bureau of Standards, where more than 18,000 samples were analyzed in the compilation of the data which has served as the basis for this paper.

S. P. Carman Opens Cons. Engr. Office

Simon P. Carman, for the past five years Superintendent Engineer, Bureau of Water, Binghampton, N. Y., has announced the opening of an office as a consulting engineer, in Binghampton.

A graduate of Rensselaer Polytechnic Institute, Mr. Carman has had a wide experience in civil engineering. Prior to 1942, Mr. Carman made studies in connection with the construction of the water supply and sewage facilities for the Bermuda Air Base and for four months in 1942 he was on a leave of absence working with the Water Supply Division of the War Production Board in Washington, D. C.

Mr. Carman has also served as Asst. City Engr., and Deputy City Engineer of the Bureau of Engineering of Binghampton, for seven years, and for a number of years was associated with Waddell and Hardesty in the design of bridges. Mr. Carman's earlier experience included teaching mathematics, erection of a dam and powerhouse, flood control measures, design and construction of water mains, sewers, pumping stations, etc.

"Si" Carman is well known in the N. Y. Section of A.W.W.A. for his conduction of round table discussions at section meetings. He is also a member of A.S.C.E., N.E.W.W.A., and Sigma Xi. Mr. Carman's new offices will be located at 736 Mutual Building, Binghampton, N. Y.

S. R. Kin Joins Indiana Bureau of Sanitary Engineering

Stephen R. Kin, Sanitary Engineer in charge of water and sewage treatment at Camp Butner, N. C., has resigned from that position and has joined the Indiana State Dept. of Health in the Bureau of Sanitary Engineering. Mr. Kin has accepted a position as Industrial Waste Engineer in Mr. B. A. Poole's department.

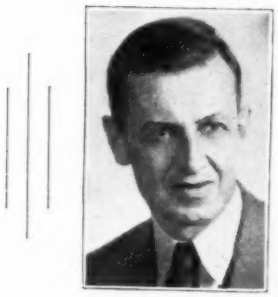
The state of Indiana, through its Stream Control Commission, is developing a program of cooperative engineering with industry on the abatement of problems of waste disposal in that state, and Mr. Kin will be associated with this work.

Prior to his work in the U. S. Army Engineers at Camp Butner, Mr. Kin was Assistant Sanitary Chemist of the Buffalo Sewer Authority, Buffalo, N. Y. He is co-author of several papers on the subject of sewage chlorination and industrial waste treatment and his most recent paper appeared in *Water & Sewage Works* last year on the subject of the control of density currents in final settling tanks.

THE DETERMINATION OF CYANIDES

by T. R. HASELTINE
THE CHESTER ENGINEERS
PITTSBURGH, PA.

SINCE I pride myself on being a scientist, I have entitled this epistle "The Determination of Cyanides." A less scientific but far more truthful title, however, might be the "Indetermination of Cyanides" or "Wanderings and Wonderings of an Engineer in Cyanogen." More than twenty years ago I received a degree in Civil Engineering. Since then I have been practicing "sanitary engineering" (what is sanitary about sewage?). During the interim I have had several struggles with chemistry; each has left me less civil, if not more chemical. The latest bout, with the chemistry of cyanides, has so addled my brain that I have brought forth this dissertation on a subject about which I know nothing—maybe it will help other engineers to avoid my fate, but I doubt it.



The Author

Importance and Sources of Cyanides

Cyanides are simple or complex compounds having one or more metallic elements combined with the radical (CN). All cyanides are highly poisonous and, when brought in contact with an acid, liberate hydrocyanic or prussic acid gas, HCN, which is also poisonous. Sterner[1] states the maximum permissible concentration for continuous exposure to this gas in an atmosphere is 20 ppm., although Norris[2] states that as little as 0.05 gram is a fatal dose. Many of the cyanides are soluble and all such are injurious to aquatic life. Ellis[3] states that 0.5 to 2.0 ppm. of sodium cyanide will kill fish in a few hours; other cyanides are at least as toxic. The presence of cyanides inhibits sludge digestion.[4]

Cyanides may originate in wastes from gold, silver, copper, cadmium, zinc, brass, or bronze plating operations, quenching waters from certain heat treatment processes and, possibly, from the neutralization of acid pickling operations[5] in the metal industries. The various plating solutions may contain from 12,000 to 40,000 ppm. of cyanides as (CN); rinse waters from plating or the other cyanide operations in the metal industries will contain materially less cyanides depending upon the type of operation and the amount of water used. Some plants never dump cyanide plating solutions while others may dump them three or four times a year.

Methods of Treating Cyanide Wastes

A study of the literature reveals that there are at least four methods of treating cyanide wastes, as follows:

1. Acidification and aeration which converts the cyanides to hydrogen cyanide gas and blows it out into the atmosphere. This method has been described by Eldridge[6] and Herda.[7] It is claimed to be possible to reduce the cyanides to about 1 ppm. as CN by this process.

2. Heating the cyanide wastes and then adding commercial lime sulphur solution which converts the cyanides to thiocyanates, i.e. compounds having one or more metallic elements combined with the radical (CNS). This method is described by Eldridge,[6] who states that it destroys the toxic effect of the cyanides. Anderson[10] shows that sodium thiocyanate is only one-third as toxic as sodium cyanide.

3. Treatment with an iron salt converts the cyanides to ferrocyanides (compounds having one or more metallic elements combined with the radical ($Fe(CN)_6$)). The reaction may be indicated by the following equation:

$$6NaCN + FeSO_4 = Na_4Fe(CN)_6 + Na_2SO_4$$

A surplus of alkali must be present (as the writer found to his surprise) or prussian blue, ferric ferrocyanide, may be formed due to the partial oxidation by the atmosphere. (This is the usual pigment in laundry bluing and although it may not be injurious, an intense blue would not be desirable in a treatment plant effluent.) Norris[2] states that ferrocyanides and ferricyanides are not poisonous, while Anderson[10] shows that sodium ferrocyanide is only about 0.57 per cent as toxic as sodium cyanide to aquatic life. Essentially this method of treatment was that used at Meadville, Pa.[4]

4. Treatment with chlorine and an alkali converts the cyanides to cyanates and chlorides. The cyanates then hydrolize to carbonates and the ammonium carbonate finally breaks down into ammonia and carbon dioxide which escape into the air. The reactions, although going through several intermediate steps, may be indicated by the following equation:

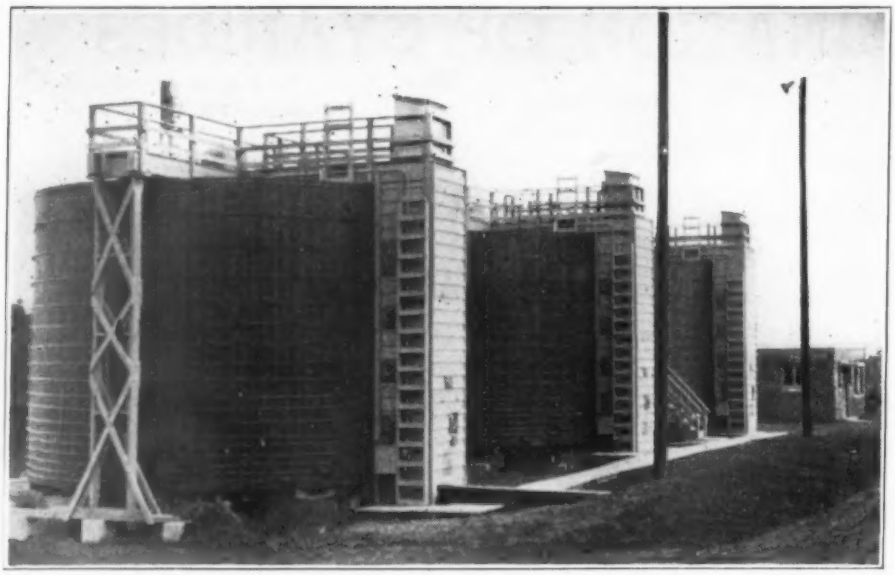
$$2\,NaCN + 2Cl_2 + 4NaOH + H_2O = NaCO_3 + CO_2 + 2NH_3 + 4NaCl$$

This method has been described by Friel and Wiest (8) and the E. I. duPont DeNemours Company.[9] The latter company states that cyanides may be reduced to less than 1 ppm. by this method while Friel and Wiest[8] imply that even better removals are possible.

There are numerous factors that may influence the method of treatment selected for treating any particular cyanide waste. To a simple minded engineer, like the writer, it appeared logical to first find out the cyanide content of the wastes and then simulate one or more of the various treatment processes in the laboratory and evaluate its efficiency by determining the residual cyanides in the treated samples before making a final selection. I soon found that "how to determine cyanides" was a $64.00 question.

Methods of Determining Cyanides

The 8th edition of *Standard Methods for the Examination of Water and Sewage* contains no test procedure for determining cyanides. (Ed. Note: The 9th Edition published in Dec., 1946, does contain a procedure for cyanides.) Theroux, Eldridge and Mallmann[11] give a qualitative test for cyanides which is sensitive to about 0.4 ppm. of cyanides as (CN). The procedure is not specific for cyanides, however, and other oxidizing agents, such as free chlorine, ferric iron, or even dissolved oxygen, may give positive results. Obviously such a non-specific test would be of little value even if it were quantitative instead of qualitative.



Batch Treating Tanks for Metal Plating Waste Treatment
(Described by Friel and Weist in the March 1945 Issue of this Magazine)

In another text Eldridge[12] gives the following quantitative colorimetric test procedure:

Reagents:

ACETONE-SULPHUR MIXTURE. To 250 ml. of acetone add 10 g. of fine yellow sulphur. The sulphur settles rapidly and when used must be thoroughly shaken and rapidly added before it has time to settle.

FERRIC NITRATE. Dissolve 5 g. of ferric nitrate in 100 ml. of distilled water.

COLOR STANDARDS. SOLUTION 1. Dissolve 0.4 g. of potassium chloroplatinate in a small amount of distilled water, add 20 ml. of concentrated hydrochloric acid, and make up to 100 ml. with distilled water.

SOLUTION 2. Dissolve 4.8 g. of cobaltous chloride crystals in a small amount of distilled water, add 20 ml. of concentrated hydrochloric acid, and make up to 100 ml. with distilled water.

Add the following amounts of each solution to 100-ml. Nessler tubes, and make up to the mark with distilled water.

Cyanide as CN, ppm.	Solution 1, ml.	Solution 2, ml.
0.5	4.5	1.0
1.0	6.0	1.6
2.0	12.5	3.8
3.0	15.2	6.0
4.0	24.5	10.0
5.0	38.0	12.5

Procedure:

1. To 100 ml. of the sample in a breaker add about 2 ml. of the acetone-sulphur mixture. Shake the mixture thoroughly, and add it rapidly.

2. Heat to boiling, and boil gently until the cloudiness disappears. Should the cloudiness reappear upon cooling, boil again until it disappears permanently.

3. Cool and add 1 ml. of concentrated nitric acid and 3 ml. of ferric nitrate solution. Filter into a 100-ml. Nessler tube, and make up to the mark with distilled water.

4. Compare the color with that of the standards.

Despite a desperate, diligent search of chemistry books the theory behind this procedure remains (to the writer at least) a deep, dark secret. We learned that when cyanide solutions were heated with sulphur, thiocyanates were formed, i.e.,

$$NaCN + S = NaCNS$$

We also learned that the addition of ferric iron salts to a thiocyanate solution produced ferric thiocyanate which has a characteristic blood-red color, i.e.,

$$3NaCNS + Fe(NO_3)_2 = Fe(CNS)_3 + 3NaNO_3$$

What the function of the acetone is we don't know, but in the presence of cyanides or thiocyanates, it must produce some yellow compound which, with the red ferric thiocyanate, produces the orange color formed when cyanides are present in the test sample.

Eldridge states the above test is suitable for determining cyanides from 0.5 to 5.0 ppm. as (CN). It seemed logical to assume that if smaller volumes of samples are diluted to 100 ml. with distilled water, that considerably higher amounts could be measured, although, as shown by Table I, this may not be the case. At any event, since cyanide wastes might range up to 40,000 ppm. (CN) a more flexible wide range test procedure appears desirable. Herda[7] gives the following procedure which at first appeared to be the answer to a maiden "cyanalyst's" prayer.

Cyanide concentrations above 50 ppm. in the wastes are determined by accurately measuring 100 ml. of sample in a volumetric flask and filtering into a 300-ml. Erlenmeyer flask. Two ml. of 10 per cent potassium iodide and 5 ml. of ammonium hydroxide are added and mixed by rotating the flask. The treated sample is titrated immediately with 0.1 N silver nitrate solution, added drop by drop until the first permanent yellow color obtains. The CN content in ppm. is calculated by multiplying the number of ml. of 0.1 N silver nitrate solution required in titration by 52.03. For CN concentration of 5 to 50 ppm. the procedure is identical except that 0.01 N silver nitrate solution is used with a calculation factor of 5.203. Likewise, samples containing less that 5 ppm. are titrated with 0.001 N silver nitrate solution and a factor of 0.5203 is used.

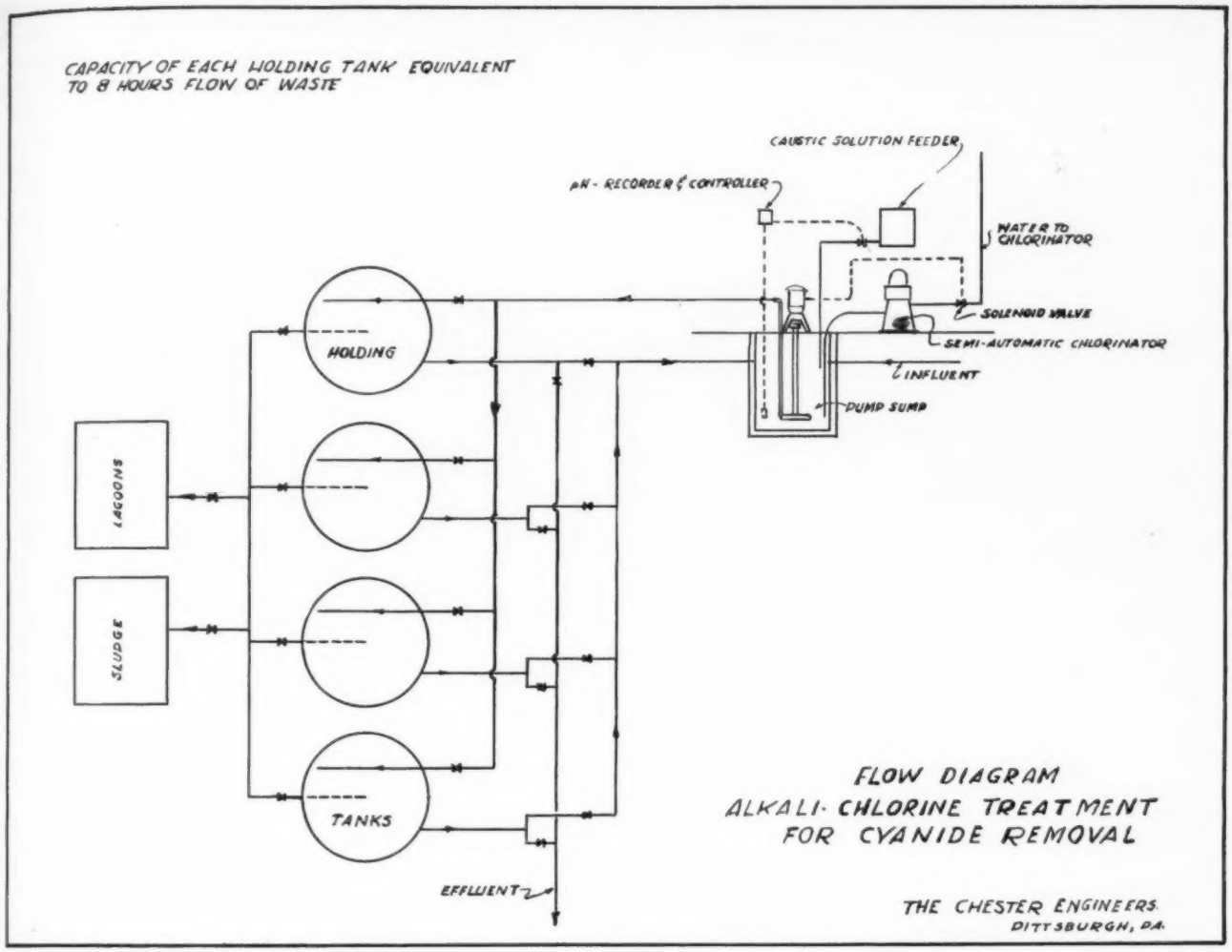
In the meantime it finally occurred to us that electro-plating chemists must be determining the cyanide content of their plating baths as a routine procedure so we investigated the procedure followed by them. It seems that these chemists usually report all cyanides as sodium cyanide but distinguish between "free cyanides" and "total cyanides." Plating solutions contain complex cyanides such as $Na_2Cu(CN)_3$, $Na_2Zn(CN)_4$, $KAg(CN)_2$, etc., and in addition a simple sodium or potassium cyanide. "Free cyanide" is this excess of the simple cyanides of sodium or potassium.

Blum and Hogaboom[13] give the following procedure for determining "free cyanides" in plating solutions.

A 10-ml. sample is diluted with water to 50 ml., 10 ml. of 0.5 N potassium iodide (containing 83 g./l. of KI) is added, and a 0.1 N solution of silver nitrate is run in gradually from a burette until a faint precipitate per-

Table I
ANALYSES OF UNTREATED CYANIDE WASTES

Sample	A	B	C	D	E	F
pH (glass electrode)	8.5	8.65	8.3	7.5	8.6	9.6
Carbonates as Na_2CO_3 ppm	26	30	15	0	1270	2790
Bicarbonates as Na_2CO_3 ppm	158	172	251	221	...	...
Settleable Solids, ml./liter	1.5	1.7	15.0	5.2	20	0.3
Total Cyanides by Eldridge Colorimetric Method Using Following Dilutions:						
1:2 ppm. CN	9	7	5	7		
1:100 ppm. CN					500+	
1:200 ppm. CN					900	
1:1000 ppm. CN					200	5000+
1:2000 ppm. CN						7000
1:10000 ppm. CN						3000
Total Cyanides by Herda NH_4OH $AgNO_3$ Method, ppm. CN	9.4	8.8	7.3	6.8	164	1780
Total Cyanides by NaOH, $AgNO_3$ Method after Carbonate Removal with Barium, Adaptation of Blum Hogaboom Procedure ppm. CN	8.9	6.8	6.8	8.5	112	1600
Free Cyanides, same as above except no NaOH	5.7	6.0	...	...	86	1580



Flow Diagram—Cyanide Removal Plant Employing Alkali-Chlorine Treatment

sists after vigorous shaking. The reaction which occurs is as follows:

$$2NaCN + AgNO_3 = NaAg(CN)_2 + NaNO_3$$

When sufficient silver has been added to form the soluble compound, $NaAg(CN)_2$, the next drop reacts with the potassium iodide to form an insoluble precipitate of AgI:

$$KI + AgNO_3 = AgI + KNO_3$$

The latter reaction, therefore, serves as an indicator of the end point of the titration. As one $AgNO_3$ molecule reacts with 2NaCN, 1 ml. of 0.1 N $AgNO_3$ is equivalent to 2 ml. of 0.1 N NaCN, i.e., to 0.0098 g.NaCN.

In addition Blum and Hogaboom[14] give the following procedure for determining "total cyanides."

Dilute a 25-ml. sample of the solution to exactly 500 ml. Dilute 25 ml. of this solution to about 200 ml. with distilled water, and add approximately 5 ml. of 10 per cent sodium hydroxide solution and 1 ml. of 10 per cent potassium iodide solution. Titrate the solution with tenth normal silver nitrate solution until a permanent faint yellow turbidity is produced. The solution should be stirred vigorously during the titration. Add a little more sodium hydroxide, and if the turbidity disappears, continue the titration with silver nitrate until a permanent turbidity is produced. One milliliter of 0.1 N $AgNO_3$ = 0.0098 g. sodium cyanide (NaCN).

It would appear that (a) by using larger samples of waste with less, or no, dilution and (b) by using weaker solutions of silver nitrate, that these procedures could serve well in the analysis of cyanide wastes. If this were done the "total cyanide" procedure would be substantially the same as that recommended by Herda[7] except that caustic soda instead of ammonium hydroxide is used. Therefore, it is very pertinent to note that Blum and Hogaboom state that the total cyanide test gives high results in the presence of ammonia, and that "addition of ammonium hydroxide, as frequently recommended for free cyanide titrations, should therefore be avoided." The data in Table I seems to confirm that statement. Frankly, the writer does not know why either caustic or ammonia is used, but presumes it is to change the complex cyanides to simple cyanides:

$$Na_2Cu(CN)_3 + NaOH = 3NaCN + CuOH.$$

Another siege with the chemistry books revealed that silver iodide was very slightly soluble in ammonium hydroxide and this probably explains why ammonia gives high results; the reaction may be indicated as follows:

$$AgI + NH_4OH = Ag(NH)_3OH + HI$$

Our text book tussle revealed the fact that AgI was also slightly soluble in sodium thiosulphate, forming the soluble compound $Na_3Ag(S_2O_3)_2$. Copper cyanide plating baths frequently contain about 2,000 ppm. of sodium thiosulphate, or "hypo" as the platers call it, and we would expect that its presence might result in cyanide titrations being on the "high side." Blum and Hogaboom state that aluminum salts and tartrates do not effect the accuracy of their total cyanide test procedure[14] but that excessive carbonates may interfere with the "free cyanide" test.[13] To eliminate this interference, they recommend the addition of a slight excess of barium nitrate followed by filtration prior to making the test. Wastes from cyanide heat treatment or copper, silver, brass or bronze plating operations are fre-

quently high in carbonates, but zinc or cadmium plating wastes do not contain much carbonate.

The duPont Company[9] gives a still different procedure for titrating cyanides with silver nitrate as follows:

Transfer 100 ml. of the solution to a 250 ml. beaker, add 0.5 ml. NH_4OH and 5-6 drops of 10 per cent KI solution. Allow to stand approximately 5 minutes which will produce a turbidity. Filter to a clear solution, then titrate with 0.01 N $AgNO_3$ solution to a faint opalescence. Subtract 0.3 ml. of 0.01 N $AgNO_3$ as a blank for each 100 ml. of solution titrated.

1 ml. of 0.01 N $AgNO_3$ = 0.00098 g. NaCN

In the case of effluents containing stable cyanides such as CuCN and AgCN, it is necessary to employ the $MgCl_2$ treatment to liberate the total HCN which is described as follows:

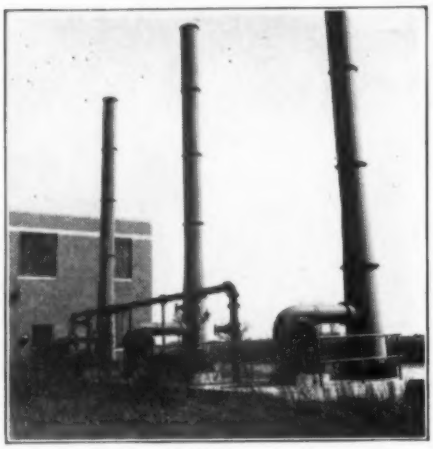
Transfer 100 ml. of the filtered solution to the distilling flask, add 2 g. NaOH (dissolved in 50 ml. H_2O) and 300 ml. N MgCl solution. Distill into approximately 5 g. NaOH (dissolved in 65 ml. H_2O). The distillation is stopped when about 35 ml. of solution has been condensed. 3-4 drops of NH_4OH and 5 drops of 10 per cent KI solution are added to the distillate solution and it is then titrated with 0.01 N $AgNO_3$ solution to bare opalescence. 0.3 ml. 0.01 N $AgNO_3$ are subtracted as a blank for 100 ml. of solution titrated. 1 ml. 0.01 N $AgNO_3$ = 0.00098 g. NaCN. The following reaction occurs in distilling HCN from an alkaline (NaOH) solution containing an excess of $MgCl_2$:

$$MgCl_2 + 2\ NaCN + 2\ H_2O = Mg(OH)_2 + 2\ HCN + 2\ NaCl.$$

For solutions containing less than 10 ppm. of NaCN, a one-liter sample is placed in a distilling flask, acidified with acetic acid and the HCN distilled over into a receiver containing 50 ml. of 10 per cent NaOH. Carry on the distillation until 35-40 ml. of distillate is collected. The condenser must be well cooled and the adaptor should dip below the caustic solution.

If sulfides are present as indicated by formation of brown coloration of Ag_2S on addition of$AgNO_3$, the solution must be treated with dry basic lead carbonate and filtered.

Add 0.5 ml. aqua ammonia and 5 drops of 10 per cent KI solution to the cooled filtrate and titrate with 0.01 N $AgNO_3$.



Willow Run Disposal Plant Neutralizes Waste Acids

Three 25 ft. chimneys serve as exhaust pipes for reaction tanks at the industrial waste disposal plant. Acids and cyanide solutions come from plating rooms at 300,000 gpd. rate.

The first procedure given by them is substantially the same as that of Herda,[7] previously described, except for the subtraction of the 0.3 ml. of $AgNO_3$ and therefore should give results about 2 ppm. lower. Perhaps this offsets the high results to be expected by the use of ammonium hydroxide; however, it would appear preferable to use caustic soda in the first place.

When it comes to their discussion of "stable cyanides" we are completely lost. So far as we can determine, both CuCN and AgCN are even less soluble than magnesium hydroxide, so the addition of magnesium chloride would have little or no effect. If by stable they mean complex soluble cyanides such as $Na_2Cu(CN)_3$ we would expect from Blum and Hogaboom's[14] statements that the $MgCl_2$ treatment was not required because the caustic converted all cyanides to sodium cyanide.

Their acid distillation procedure should effectively change all cyanides to sodium cyanide and so permit direct titration with good accuracy. However, it may involve some hazard if not performed in a fume hood.

Friel and Wiest[8] give still another test for cyanides. Their procedure is as follows:

Place 10 ml. of sample in a crucible, add two drops of ten per cent solution of sodium hydroxide; place on hot plate and dehydrate—

Add one drop of two per cent solution of ferrous sulfate and allow to stand for fifteen minutes, then add two or three drops of hydrochloric acid and warm on hot plate; add a few drops of distilled water. If cyanide is present, the test solution will turn a blue-green. The quantity of CN is determined by the preparation of colorimetric standards using known increments of salts of cyanide.

They do not give the chemistry of this test but we assume that the NaOH is first added to convert any complex cyanides to sodium cyanide which will then remain as a residue after dehydration. The dilute ferrous sulfate will then react with the cyanide to form sodium ferrocyanide and ferrous ferrocyanide. The addition of HCl and heat converts all of the sodium to NaCl. Some of the iron is oxidized by the air to $FeCl_3$ and, upon the addition of water produces a yellow color if no cyanides were initially present. However, if cyanides were present, some ferric ferrocyanide is formed which causes a blue precipitate. If only a very small amount of cyanides were originally present, a light green color is produced but higher initial cyanides result in a deeper blue color. Although the proponents of this test procedure claim that color standards may be made which permit quantitative measurements, we believe the range of the test to be small. Its chief merit is as a qualitative test to detect small amounts of cyanides in the presence of other oxidizing agents such as chlorine.

Table II
ALKALINE-CHLORINE TREATMENT

Test No.	Sample Tested	NaOH Added ppm.	Chlorine Added ppm.	Source of Chlorine	Sludge by Volume After 2 Hours %	Final pH	Residual (CN)	Test Method Used
1	F	2000	6000	Commercial Bleach	22	10.8	1660 ppm.	NaOH -$AgNO_3$ Titration, no carbonate removal
2	F	2000	8000	"	50	...	1660 ppm.	"
3	B	660	52	"	2	11.6	7.3 ppm.	"
4	F	2000	1800	Sodium Hypochlorite	Trace	...	Present	Friel & Wiest
5	F	2000	2700	"	"	11.0	Absent	"
6	B	2000	6	"	"	10.6	Present	"
7	B	2000	18	"	"	11.3	Present	"
8	B	2000	30	"	"	11.55	Absent	"
9	B	2000	42	"	"	11.55	Absent	"

Note: Attempts to apply Eldridge colorimetric method to test No. 5 gave a deep blue precipitate when the Fe $(NO_3)_3$ was added and filtration did not eliminate all of the blue color. A very faint blue-green color was also obtained when that procedure was applied to tests Nos. 7, 8 and 9; a somewhat darker green was obtained with test No. 6.

All cyanide determinations except the Eldridge colorimetric determinations on tests Nos. 6 to 9 inclusive were made within 3 hours after application of chemicals. The latter determinations were made 16 hours after addition of chemicals.

Application of Cyanide Test Procedures

Recently we studied wastes from an industry using both cyanide copper plating and cyanide hardening operations, all of which were conducted in the same room. Routine wastes represent overflow from a water quench tank following the cyanide furnaces and a small overflow from two alkaline cleaning tanks both of which are agitated and heated by live steam; their overflow is caused by the condensation of that steam. One of these tanks precedes, and the other follows, copper plating. Samples A and B in Table I are representative of

these routine wastes. Samples C and D were collected from the main plant sewer and contain sanitary sewage and some spent cooling water in addition to the routine cyanide wastes. About once a month the floors and equipment used in the cyanide operations are washed down over a 4 hour period. Sample E is a composite of this washdown. Sample F was taken at the time the alkaline cleaning tank following plating operations was being dumped, but it is diluted with some wash water. The plating solutions themselves are not dumped at this plant.

Table I shows the results of total cyanide determinations made by three of the above procedures, together with some other analytical data that may or may not be pertinent. Table II contains the results of analyses of samples by different methods, after treatment with caustic soda and chlorine. Table III contains similar data on effluents from treatment with ferrous sulfate. We believe that the data warrant the following conclusions.

1. If the wastes or effluents from treatment plants contain from 5 to 10 ppm. of cyanides, their cyanide content may be approximated by either the Eldridge colorimetric procedure or by the addition of KI and NaOH followed by titration with silver nitrate.

2. If the wastes contain as much as 100 ppm. of CN, their cyanide content cannot be estimated by the Eldridge colorimetric procedure because with high dilutions of the waste this method gives very erratic results. Such a fact does not appear reasonable or logical but repeated trials have proved it to be true, as evidenced in Table I.

3. The use of ammonium hydroxide instead of caustic soda in the $AgNO_3$ titration procedure gives higher results, which are believed to be erroneous.

4. In the alkaline-chlorine treatment of cyanide wastes, sodium cyanate (NaOCN) is formed which hydrolizes to $(NH_4)_2\ CO_3$ and Na_2CO_3. Considerable time is required for the completion of the hydrolysis and if any unhydrolized cyanate remains, it reacts with $AgNO_3$ in the same way as the cyanides do and so silver nitrate titration procedures are unsuitable for controlling the effectiveness of the alkaline-chlorine treatment process. Something more than 16 hours is required for completion of the hydrolysis.

5. When the Eldridge colorimetric procedure is used to measure the cyanide content of samples containing cyanates, a blue precipitate (probably Prussian blue which is ferric ferrocyanide) is formed that cannot be entirely removed by filtration, and so the Nessler tubes have a green or bluish color. Such color makes it impossible to secure a match with the color standards. Therefore, the Eldridge procedure is unsuitable for controlling the effectiveness of the alkaline-chlorine treatment procedure.

Cyanide Waste Treatment Plant
Chevrolet Motor Co., Flint, Mich.

6. In the Friel-Wiest method of measuring cyanides, hydrolysis of the cyanates is speeded up by driving off the ammonia and carbon dioxide gases. Therefore, the cyanates are removed and cannot interfere with the test. The test procedure is well adapted to the control of the alkaline-chlorine procedure for treating cyanide wastes.

7. The Friel-Wiest procedure does not have sufficient range to make it suitable for measuring high cyanide contents. It is, however, a satisfactory procedure for checking on residual cyanides in treatment process effluents.

8. The Friel-Wiest method of measuring cyanides is not specific for cyanides; it measures ferrocyanides as well. Therefore the method cannot be used to measure the effectiveness of the ferrous sulfate treatment for removal of cyanides.

9. Orthotolidine forms a precipitate with the effluent from the alkaline-chlorine process of cyanide removal which interferes with residual chlorine determinations. Therefore, that test cannot be used to control the process.

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Table III
ALKALINE FERROUS SULFATE TREATMENT

Test No.	Sample Tested	NaOH Added	$FeSO_4$ Added	Sludge by Volume After 2 Hours %	Final pH	Residual (CN)	Test Method Used
10	F	2000	24800	46*		High	Friel & Wiest
11	B	2000	120	5	11.6	1.9 Present	Eldridge Colorimetric Friel & Wiest
12	B	2000	240	6	11.45	Present	Friel & Wiest
13	B	2000	480	7	11.5	1.5 Present	Eldridge Colorimetric Friel & Wiest
14	B	2000	720	9	11.6	1.2 Present	Eldridge Colorimetric Friel & Wiest
15	F	0	540	4	9.6	?	$NaOH$-$AgNO_3$ Titration—no carbonate removal
16	F	0	650	8	9.6	470	
17	F	0	810	8	9.6	240	Same
18	F	0	1080	26	9.65	104	"

Notes—(1) Test 15 turned blue during and after filtration so could not be tested for cyanides.
(2) Sludge in tests 11 and 12 was a light golden brown color; sludge in test 13 was a dark brown and that in test 14 was a dark greenish brown almost black.
*After about 16 hours instead of 2 hours.

DETERMINATION OF B.O.D. VALUES BY CHEMICAL OXIDATION

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FORT JACKSON, S. C.

THE idea of measurement of Biochemical Oxygen Demand of sewage by chemical oxidation is at first glance contradictory to the general concept of bacteriological oxidation, but it can be justified on the following theoretical grounds plus the fact that it actually can be done. Although oxidation of sewage under natural or treatment plant conditions undoubtedly follows a complicated course with various bacteria forming a team to finally oxidize all of the organic matter to a stable condition, it is a fundamental principle of stoichiometry that where calculations involve the starting compounds and end products of a chain of reactions all intermediate products can be disregarded. This means that the oxidations taking place in sewage or industrial wastes can be reduced to a few simple reactions such as:

$$C + O_2 = CO_2$$

$$2N_2 + 5O_2 = 2N_2O_5$$

$$2S + 3O_2 = 2SO_3$$

$$2H_2 + O_2 = 2H_2O$$

From the above it follows that any oxidizing agent capable of causing this type of resultant reaction to occur in a form permitting measurement of the oxygen involved should give a figure corresponding to the ultimate oxygen demand of a sewage or waste sample. The well established figures for relationship between B.O.D. values at various temperatures and incubation periods should enable the chemical oxidation results to be converted to standard B.O.D. values by strictly logical methods.

Previous Work

Considerable work has been reported on the determination of carbon in sewage and efforts have been made to correlate these findings with the standard B.O.D. After a number of false starts on this project the writer concluded that the work of Mohlman and Edwards[1] and of Burtle and Buswell[2] held the key to the problem. The report of Burtle and Buswell was particularly interesting in that these investigators compared the relative efficiencies of several oxidizing agents and then compared the results from the most promising of these (potassium dichromate in phosphoric and sulfuric acids) with results from the standard dilution methods and the Nordell Odeeometer procedure.

The Author

Mohlman and Edwards, using Chicago sewage containing packinghouse wastes, reported rather inconclusive results and had considerable difficulty with grease sticking to the walls of their reaction vessel and "creeping" away from their reagent. Burtle and Buswell, using Champaign-Urbana sewage, worked out a very precise and reliable method for determining carbon but had little success in correlating the carbon content of sewage with the oxygen demand as determined by the standard dilution methods or the Nordell Odeeometer, these last two holding together quite well.

Proceeding from the tables and formulas given by Imhoff and Fair[3] and others, and the statement by the same authors that the carbonaceous matter in sewage is largely oxidized before nitrogenous and other matters are attacked, it would appear that the five-day B.O.D. of sewage at 20° C. should be slightly less than 76 per cent of the oxygen required to oxidize the carbon in the same sample. This figure is not too reliable, due to the uncertainty of the exact end point of the so-called "first stage" of oxidation. Actually, as shown in Table I, the ratio was less than half of this value.

This brings us to one of the principal difficulties in this type of determination; that is, the presence in sewage of considerable quantities of cellulose. This carbonaceous compound is noted for its chemical stability and resistance to aerobic action, although it digests anaerobically fairly rapidly. It is readily oxidized by this dichromate reagent, and being present in sewage in highly variable amounts, it makes the establishment of a reliable ratio between organic carbon and B.O.D. impossible. Furthermore, there probably are various organic compounds present in fresh sewage which have sufficient oxygen in the molecular structure to result in formation of carbon dioxide with a part of the carbon atoms present. Since both sets of investigators measured carbon by precipitating the carbon dioxide produced in the form of barium carbonate, the presence of oxygen in the organic molecules of sewage would introduce an appreciable error. Note that sample (a), Table I, which was taken after a heavy rainstorm, shows a much higher ratio of B.O.D. to calculated oxygen demand than the others, which would agree with the expected reduction in the percentage of cellulose in sewage under stormflow conditions.

TABLE I

Organic Carbon (B & B²)	Calculated Oxygen Demand	Standard Methods B.O.D. (B & B²)	B.O.D. Divided by Calculated Oxygen Demand
	Raw Sewage		
196 ppm	521 ppm	121 ppm	23%
187	497	135	27
(a)52	138	60	43
160	426	125	29
128	340	99	29
172	456	153	34
164	436	131	30
	Filtered Sewage		
85	226	74	23
133	354	95	27
146	388	94	24
150	399	113	28
170	452	93	20
178	473	180	38

Seeking a More Rapid and Dependable Method for Determining BOD Values

It was the aim of the author to develop a reasonably rapid and simple method of determining B.O.D. as an aid to sewage treatment plant control. This eliminated methods of determining carbon by carbon dioxide measurement for the reasons mentioned above, plus the fact that several hours and fairly elaborate apparatus are required for the complete determination. There was left the possibility that dichromate reagent would sufficiently oxidize the organic matter of sewage so that the standard five-day B.O.D. could be calculated as 68.4 per cent[3] of the ultimate demand, as determined by rapid chemical oxidation.

The very dilute nature of crude and treated sewage causes some difficulty at the outset. Proper and complete contact of the oxidizing agent must be had with the organic particles in the sewage. Conditions of the reaction should also be such that inert organic materials such as cellulose will not be affected. Furthermore, it was desired for convenience and economy to use as much as possible those materials and technics available in most sewage works laboratories. This led to the sodium thiosulfate titration of dichromate, using iodine and starch—a rather unhandy business but giving reasonably reliable results with a little practice.

Technic of the Method

Reagents

1. Dichromate Oxidizing Agent: 500 ml. concentrated sulfuric acid, 500 ml. 85 per cent ortho-phosphoric acid, 1.25 gr. potassium dichromate. Mix well and allow to cool before using.

2. Sodium Iodide Solution: A 20 per cent solution of c.p. Sodium Iodide in distilled water.

3. Sodium Thiosulfate, 0.025N; Prepared as outlined in "Standard Methods for the Examination of Water and Sewage" (9th Edition, 1946).

4. Soluble Starch Solution: (9th Ed., "Standard Methods").

Apparatus

100 ml. pyrex beakers. Mark these beakers as accurately as possible at the 20 ml. volume, determined by placing 20 ml. of water in each beaker.

Procedure

Prepare a sufficient number of marked 100 ml. beakers for the samples to be run plus a blank. All samples and blank should be run in duplicate. Place exactly 20 ml. of dichromate reagent in each beaker. Add a sufficient quantity of each sample to use about half of available oxygen as measured by the thiosulfate titration. This will be approximately 5 to 10 ml. for crude domestic sewage, 10 to 20 ml. for primary settling tank effluent, and proportionately larger amounts for effluents of secondary treatment units, depending on degree of treatment. In no case should the sample volume be over 50 ml. For samples with very low B.O.D. it may be necessary to use larger volumes in larger vessels, while for a very strong sample it may be better to use more dichromate—in which case mark the reacting vessel at the volume of dichromate reagent used. Assuming 100 ml. beakers are used, add sufficient distilled water to make the volume of water plus the sample up to 50 ml. Use 50 ml. of water with blanks. Mix well by stirring with a glass rod to avoid "bumping."

Heat the flasks so that boiling is fairly vigorous, being careful that no liquid is lost by splashing. When the volume of liquid in the beaker is very nearly down to the 20 ml. mark, readjust the heat so that boiling just ceases. When the volume gets down to the 20 ml. mark, hold at this point for approximately four minutes and allow to cool enough to be handled readily with the bare hands.

Pour contents of the beaker into a 250 ml. Erhlenmeyer flask. Rinse the beaker thoroughly, pouring rinsings into the flask. Use enough distilled water to make the liquid in the flask about 125 ml. Add 3 ml. of 20 per cent Potassium Iodide solution and mix well.

Titrate with the standard sodium thiosulfate solution. Thiosulfate must be added slowly. When the solution in the flask approaches a pale yellow-green color, add soluble starch as for dissolved oxygen determination. Continue adding thiosulfate very slowly with constant mixing until the color changes from blue to pale green. (Better practice this beforehand.)

Calculation

$$\text{B.O.D.} = \frac{\text{(ml. thiosulfate blank—ml. thiosulfate sample) x 200 x 0.68}}{\text{ml. sample}}$$

The critical point of the whole procedure is the matter of bringing the volume of the boiling mixture down to 20 ml. and properly regulating the temperature. A little too much heating oxidizes the cellulose, while too little heating gives low results. The situation is not so critical with filter effluent or final effluent. It is believed that a good bit of difficulty was caused by rather crude beaker markings plus the fact that heating was done on an ordinary electric stove which did not permit sufficiently accurate temperature control. A solid-top hot-plate with rheostat controls large enough to hold a number of beakers should help considerably.

Results Obtained

Results of a series of determinations by this method are rather encouraging, as set forth in Table II. Determinations can be made in less than two hours. All work was done with the regular plant samples and compared with the routine B.O.D. determinations using bicarbonate dilution water and the azide modification of the Winkler method for dissolved oxygen.

TABLE II

	Raw Sewage		Settled Sewage	
Sample	Calculated B.O.D.	Std. Methods B.O.D.	Calculated B.O.D.	Std. Methods B.O.D.
1	375	385	89	96
	348	325	94	104
2	215	200	63	67
	201	210	72	70
	217	...		
3	287	226	64	37
	253	226	65	30
4	207	85	107	150
	144	55	124	143
5	277	240	78	130
	321	230	83	143
6	188	320	107	...
	223	270	106	115
			106	...
			118	119
7	199	215	94	127
	204	230	102	120
	209	215	109	123
Avg.	242	228	93	105

TABLE II (Continued)

	High Rate Filter Effluent		Plant Effluent	
Sample	Calculated B.O.D.	Std. Methods B.O.D.	Calculated B.O.D.	Std. Methods B.O.D.
1	59	...	35	...
	49	50	37	33
	59	55	37	39
	67*	...	35	...
2	28	...	21	30
	27	30	26	27
	27	28	30	30
	28	28	...	...
Avg.	39.5	38	31	32

*Excluded from average.

From the results given, it is obvious that it is difficult to obtain reliable results with raw and settled sewage. The random nature of the variations from Standard Methods values indicates that the difficulty is more a matter of technic than method and can be overcome by further study.

This report is presented because the method even in its present crude form has shown some practical usefulness. The writer, having found that "spare moment" research has a habit of spreading out all over the calendar, hopes to interest some real research worker in this line of investigation. Study is being continued in the effort to gain increased reliability and to determine whether this reaction really oxidizes a sufficient portion of the organic matter of sewage to prove representative.

In conclusion, the writer wishes to express his appreciation for the cooperative attitude of the Fort Jackson Post Engineer Section; Mr. George M. Speed, Post Sanitary Engineer; and for the encouragement and review of this report by Mr. James H. Stephens, Director of the Division of Sanitary Engineering of the South Carolina State Board of Health.

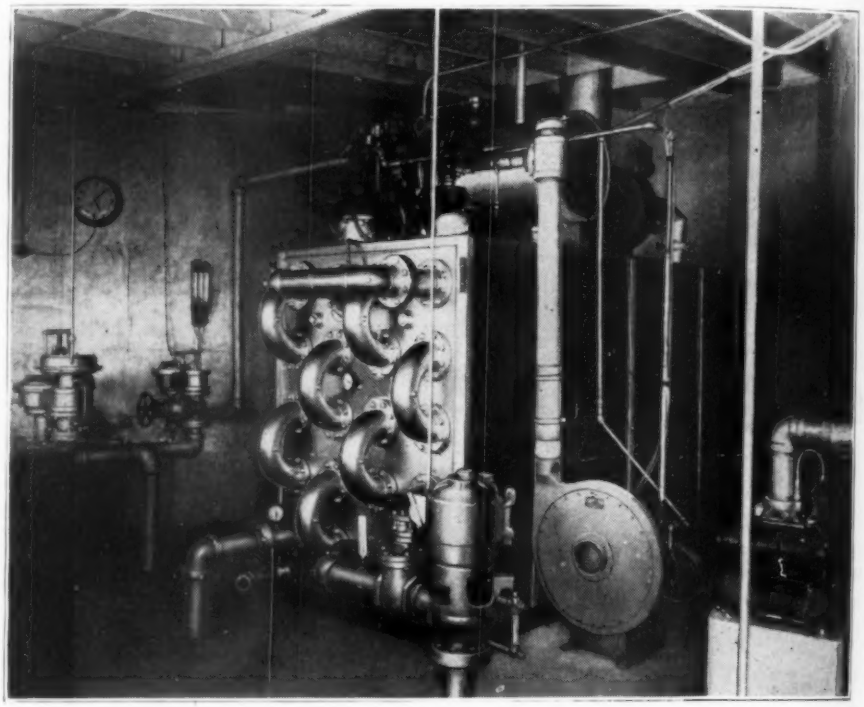
References

1. Mohlman and Edwards—"Determination of Carbon in Sewage," *Journal of Ind. and Eng. Chemistry*, Anal. Ed. 1931-32.
2. Burtle and Buswell—"Oxygen Demand Studies," *Sewage Wks. J.*, March, 1937.
3. Imhoff and Fair—"Sewage Treatment," pp. 37-40.

YEAST WASTE TREATED AT CRYSTAL LAKE, ILL.

To eliminate the pollution danger and the odor nuisance caused by its waste, the National Grain Yeast Corp. of Crystal Lake, Ill., has installed a waste treatment plant. Waste material from yeast manufacture is particularly odorous, and as a further means of decreasing the nuisance in the community, the company located the waste treatment plant approximately a mile from the manufacturing establishment. The waste is pumped to the treatment plant.

Two stage digestion is practiced, both tanks being 50-ft. digestion tanks, the first equipped with a floating cover and the second covered with a fixed concrete slab. The digestion period is approximately four days. The temperature in the digestion tanks is maintained by a PFT Combined Digester Heater and Heat Exchanger. This unit does away with problems of decreasing heat transfer caused by crust on coils and reduces labor of cleaning coils, etc. It is the first installation of this type of heat exchanger on industrial waste. This particular heat exchanger has a capacity of 1,000,000 Btu. per hour. Gas produced ranges from 1,000 to 1,500 cubic feet per hour, or more than 50 per cent of the heat required. Waste gas burners and flame trap controls are included to provide safety.



PFT Digester Heater and Heat Exchanger—1,000,000 Btu. Per Hour Normal Output

The digested liquor from the digestion tanks is subjected to trickling filter oxidation by rotary distributor at high rates of application. The effluent from the plant is relatively low in B.O.D. and discharged into a nearby stream which empties into the Fox River.

Waste Treatment Plant of National Grain Yeast Corp., Crystal Lake, Ill.

A MANUAL FOR SEWAGE PLANT OPERATORS

(A Book Review)

THERE now has been published a Manual for Sewage Plant Operators. Written by 29 authors of the Texas Water and Sewerage Short School, this book of 435 pages is composed of 27 chapters, 5 appendices and an index.

The book is dedicated to V. M. "Vic" Ehlers, C. E. . . . "the gracious, kindly, and lovable personality who has in his long and successful experience seen the Sanitary Engineering Division of the Texas State Dept. of Health grow from a one-man department to one employing directly and indirectly several hundred persons."

Prepared as a companion book to the Manual for Waterworks Operators published in 1943 by the Texas Water and Sewerage Short School, this Manual for Sewage Plant Operators has been written "for the help, education and guidance of sewage works operators," as well as a source of information for them.

In any appraisal of a text book one looks first for its overall usefulness in respect to the purpose for which it was prepared. Certainly this is the type of book that is excellent for instructing sewage plant operators in the general field of sewage works operation. There are a number of chapters which are of greater interest to operators in the state of Texas than elsewhere, but this does not in any way detract from the general usefulness of the book; in fact, it might be well for others to know of such things as the use of sewage in irrigation, the design and operation of the Dunbar Sand Filter, and the Hays process which has found its greatest use in that state.

Of particular interest is the series of questions at the end of each chapter. The 27 chapters and 5 appendices cover such topics as composition, chemistry and biology of sewage in its relation to public health; design, maintenance, and operation of individual processes; laboratory control; mathematics; state standards; certification; and the glossary, among many other items.

In the discussion of the sampling of sewage, the importance of weighting averages is brought out, and the chapter on sewer maintenance and design is something with which operators of sewage plants are usually not familiar. There is also information on design of sewage pumps and lift stations, as well as a good chapter on sewer maintenance and another on the organization of financing of a new sewer system and new sewage disposal plant.

Persons who have been asked at various times as to how to design and construct a septic tank for various size families will find the answer in this book. Among other random comments, some perhaps of a critical nature, one might include the following. In the chapter on Imhoff tank operation and foaming, the suggestion is made to add lime. This treatment seems to be losing favor, according to recent investigations and theories. In the discussion of chemical precipitation, the book includes the auto-oxidation process of Phoenix, Ariz., and also mentions various patented processes, but most of these are un-named. This section does contain information on how to run a jar test and various analytical methods for determining the requirement of iron salts when they are used for chemical coagulation.

The chapter on chlorination includes the five classic theories as to the possible action of chlorine but does not mention the recent enzyme theory. In addition to the Hays process, the chapter on other treatment methods includes dilution, ponds and lagoons. This information is of considerable interest to persons in that area but may be less so to other sections of the country.

Just why the chapter on Maintenance should contain a list of books, articles and journals on the whole subject of sewage treatment is not apparent. Unfortunately this book was prepared before the 9th edition of Standard Methods for the Examination of Water and Sewage was issued, and a note should be made that the address of the American Public Health Association as given in this chapter is incorrect, as is the address of Water and Sewage Works magazine. It seems rather strange that the form and type of operating reports should be included in a chapter on maintenance, and it is noted that there is nothing in this chapter on planned maintenance of which so much was heard during and since the war, but there is a section in this chapter on plant beautification.

The chapter on industrial wastes includes a discussion of the basis for charge but omits reference to the California Sewage Works Association report on this topic. This chapter does include treatment for various specific wastes and gives a list of references for each. There is also a chapter on the commercial utilization of sewage treatment products, including sludge, sludge gas, and effluents. It is noted that in the chapter on stream pollution the value of 8.3 lb. is used as the weight of a gallon of water, but in the chapter on laboratory control, the value of 8.34 is used. It is also noted that a chapter on laboratory control begins with a bacteriological section and presents the plate count first. This is followed by the chemical tests in which the actual technics are given stepwise and numbered much in the fashion of the Theroux, Mallmann and Eldridge textbook on Analysis of Water and Sewage.

The Texas manual throughout refers to the 8th edition of Standard Methods for the Examination of Water and Sewage, and any methods included therein that are taken from the 8th edition should be checked against the 9th edition to make sure that there have been no changes.

A chapter on mathematics, measurements by weirs, Parshall flumes, etc., and calculation of pump efficiencies are included, along with calculations of trickling filter loading and measurement of sludge chemical treatment, and other items.

The last chapter of the book contains the Texas State Standards for Design, Operation, and Recording of Sewage Works, and the appendices contain a certification of sewerage system operators; the glossary, which is taken from the out-of-date Manual of Engineering Practice No. 2 of the A.S.C.E.; safety and first aid; useful information of tables; and lastly, useful publications, both books and magazines.

The Manual for Sewage Plant Operators is published by the Texas Water Works and Sewerage Short School and distributed through the cooperation of the Texas State Dept. of Health and the Sanitation Research Foundation in Austin, Tex. It may be ordered from the Short School, attention Mrs. Earl H. Goodwin, Asst. Secy.-Treas., 501 W. 33rd St., Austin, Tex. The price of the book is $3.50.

ELKHART PLANNING ADEQUATE SEWAGE WORKS

A Story of How It Happened and What It Took

By E. C. BRADY
City Engineer
ELKHART, IND.

AT the end of the war there was a pressing responsibility to provide post-war work to help take up slack caused by reconversion from war effort to normal manufacturing of civilian goods and the normal pursuit of business and happiness. Elkhart, Ind., was no different in this respect than any other city, and construction of adequate sewage works appeared to be a solution.

Many times the city engineer has been embarrassed by inquiries as to sewer sizes in good factory location sections of Elkhart. The answer, too often, was "there is no sewer available." To inquiries from residents without a sewer as to how to obtain one, the answer was that topography and elevation of the land made it impossible to extend the present sewers.

Much of the area in which sewers are unavailable for the reasons listed above, was land acquired in 1928 by an ordinance extending the boundaries of the city, and the old sewer system had not been planned to serve this area. Any plan for a new sewage treatment works and interceptors must of course include this area.

Fortunately Elkhart had a post-war planning fund for this sewer program. The fund available amounted to $100,000 and had been obtained in a rather interesting manner, well worth relating.

How it Happened

With some sections of the city lacking sewer facilities and with basements in other sections subject to flooding, it was obvious that some sanitary improvement was necessary. Naturally, everyone was for such a project as long as it did not involve a special assessment for any district to be served, or district which had once paid a special sewer assessment.

And then it happened: A large, well-known firm made overtures to the city to locate therein. The manufacturer required that a public sewer be available along at least one street abutting the site chosen. There were no sewers in that area. This meant that one must be constructed.

About that same time the Indiana Stream Pollution Control Board issued an order to Elkhart to build a sewage treatment plant. It seemed that the downstream neighbors on the beautiful St. Joe River objected to the gratuitous contribution of Elkhart to the depreciation of their river frontage real estate, to say nothing of the potential health hazard of a sewage polluted stream. This order was in reality a blessing in disguise. We are going to have a new sewage treatment plant, and inasmuch as sewers are necessary to convey the sewage to the plant it seems reasonable to provide sewers of adequate capacity as a part of the project.

The First Step

With our destination determined, we sought the cooperation of the Elkhart Post War Planning Commission, the Chamber of Commerce, the C.I.O., A.F. of L., U.M.W., J.A.C. and other interested groups. The entire story of the problems involved was presented to this committee representing the various groups. This story included a digest of statistics on the available factory sites not served by sewers. The story also included the essential parts of the Stream Control Board order and the law which created the Control Board, as well as information on the creation and operation of both the Indiana Economic Council and the Federal Works Administration. With this information available the committee agreed unanimously to support the entire project as outlined. As concrete evidence of this support, the committee circulated a statutory petition addressed to the Common Council, asking that the Council take the necessary action to issue revenue bonds to pay for the construction of the project, and all other steps deemed advisable.

In the meantime, several consulting engineers were notified that the project was b e i n g contemplated. These engineers were interviewed by the Board of Public Works and by the Common Council, and a contract was executed between the Board and the chosen firm. The contract provided that the firm would furnish a preliminary survey for a stipulated amount, to be credited later against the fees to be paid if and when the project was completely engineered.

Prior to entering the contract, a preliminary estimate of the total engineering cost, approximately $100,000, was made, and Elkhart applied for the amount to both the Indiana Economic Council, and the F.W.A.

With the contract for engineering services ratified by the Council, the next step was to file supplementary data with both lending agencies. The urgency of the need was stressed and it was pointed out to both agencies that the application had a sound economic reason underlying it. This sound economic basis lay in the increase in real estate value, the possibility of industrial growth, and the absolute necessity of considering the sewers and treatment plant as one.

Further Steps

The next step was to have the Common Council pass another resolution. This resolution reviewed the previous steps taken, ratified the application of the Board, empowered the Mayor to issue a receipt for the money and to sign whatever evidences of indebtedness were necessary. Certified copies of this resolution were forwarded to both agencies, and a note payable to the State of Indiana was executed by the Mayor. Within a week, an allotment of $60,000 was received from the State Auditor, and the F.W.A. paid the first of two installments on its $40,000 allotment for engineers' fees and plans.

The next step is an ordinance authorizing the issuance of revenue bonds in amounts possibly a quarter to a half million dollars at a time as the work progresses. When the final bonds are sold, the loans will be retired and this post-war project will be a reality, contributing to a better Elkhart.

If this review of the steps involved in getting the project under way seems to suffer from over-simplification, let the reader be assured that the earnest, unqualifiedly cooperative efforts of every one in the municipal administration was needed together with the public spirited support of the civic organizations and the personal help of the representatives of the Indiana Economic Council and the Bur. Com. Fac. of the F.W.A.

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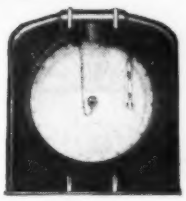
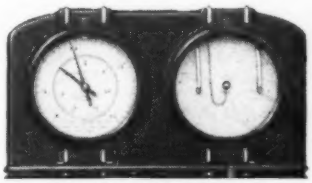
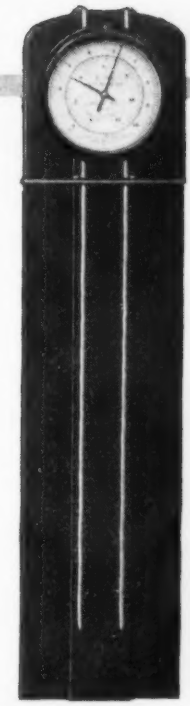


Model GA1-R Gauge recording loss of head, rate of flow or water level.



Model GA82-IR Gauge indicating and recording loss of head and rate of flow.



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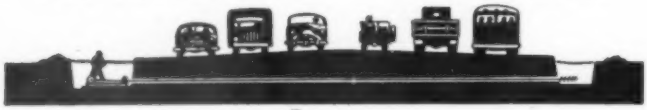

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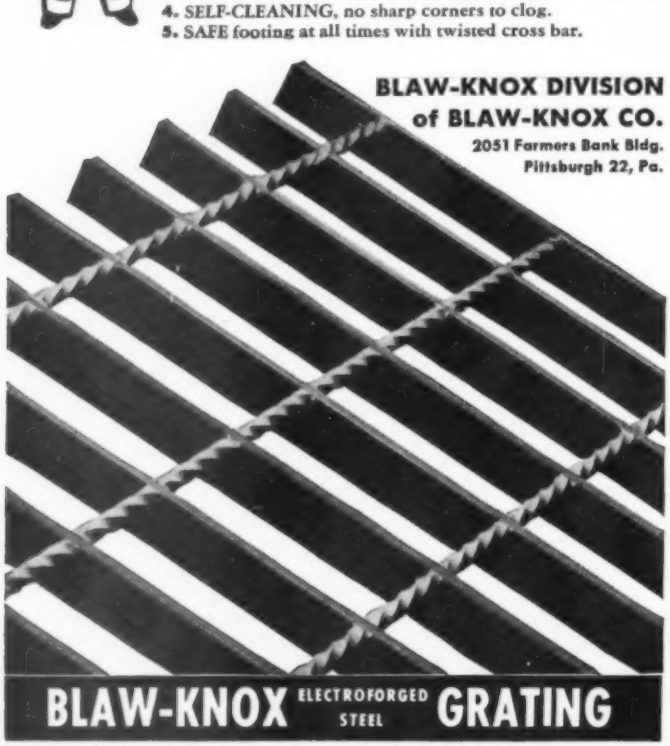

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MEETINGS SCHEDULED

May 15-16—WASHINGTON, D. C. (Hamilton Hotel)
Maryland-Delaware Water & Sewerage Assn. Sec'y-Treas., E. Virginia Gipe, State Dept. of Health, 2411 N. Charles St., Baltimore, Md.

May 15-17—VICTORIA, B. C. (Empress Hotel)
Pacific Northwest Section A.W.W.A. Sec'y, Prof. Fred Merryfield, Oregon State College, Corvallis, Ore.

May 21-22—LAFAYETTE, IND. (Memorial Union Bldg., Purdue Univ.)
Third Industrial Waste Utilization Conference. Gen. Chairman, Prof. Don E. Bloodgood, Purdue University, Lafayette, Ind.

May 22—MANCHESTER, N. H. (Country Club)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

May 23-24—BIRMINGHAM, ALA. (Thos. Jefferson Hotel)
Alabama-Mississippi Section A.W.W.A. (Organization Meeting). Sec'y, A. N. Beck, Bureau of Sanitation, State Department of Health, Montgomery 4, Ala.

May 26-27—ALBANY, N. Y. (Hotel Ten Eyck) (Joint Meeting).
New York State Sewage Works Association. Sec'y, A. F. Dappert, State Dept. Health, Albany, N. Y.
New England Sewage Works Association. Sec'y, W. E. Merrill, 611A State House, Boston, Mass.

June 4—ROCKLAND, ME.
Maine Water Utilities Association. Secretary, Earl A. Tarr, Winthrop, Me. (See June 11 also)

June 11—PORTSMOUTH, N. H. (Wentworth-by-the-Sea)
New England Water Works Association. (June Outing) Secretary, Jos. C. Knox, 609 Statler Bldg., Boston, Mass. (Maine W.U.A. and New Hampshire Water Works Ass'n. are joining this Outing.)

June 9-14—GAINESVILLE, FLA. (University of Florida)
Florida Sewage Works Association. Sec'y-Treas., J. R. Hoy, 404 Hildebrandt Bldg., Jacksonville, Fla.

June 12-13—PITTSBURGH, PA. (Roosevelt Hotel)
Western Penna. Section A.W.W.A. Sec'y-Treas., Earle P. Johnson, 418 Flannery Bldg., Pittsburgh, Pa.

June 12-14—UNIVERSITY, ALA. (University of Alabama)
Alabama Water & Sewage Association. Alex O. Taylor, Director of Eng. Extension Service, Ala. Polytechnic Institute, Auburn, Ala.

June 18-20—BATON ROUGE, LA. (Louisiana State University)
Tenth Annual Water & Sewage Short Course. Director, John H. O'Neill, Dept. Public Health, P. O. Box 630, New Orleans 7, La.

June 19—BOONTON, N. J.
N. J. Section A.W.W.A. Outing. Sec'y, C. B. Tygert, Box 178, Newark, N. J.

June 20-21—DULUTH, MINN. (Spalding Hotel)
Central States Sewage Works Assn. Sec'y, P. W. Reed, 1098 W. Michigan Ave., Indianapolis, Ind.

July 21-25—SAN FRANCISCO, CALIF. (Auditorium)
American Water Works Association 1947 Conference. Executive-Secretary, Harry E. Jordan, 500 Fifth Ave., New York 18, N. Y.

July 22-24—SAN FRANCISCO, CALIF. (Auditorium)
Federation of Sewage Works Associations. (20th Annual Meeting.) Executive-Secretary, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

(Meetings and Exhibits in the Auditorium.) Application blanks for hotel accommodations may be obtained from the respective Association Headquarters.

Aug. 13—CARIBOU, ME.
Maine Water Utilities Assn. Sec'y, Earle A. Tarr, Winthrop, Me.

Aug. 25-27—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Sewage Works Assn. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa.

MEETINGS SCHEDULED

Aug. 27-29—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Assn. Sec'y, I. M. Glace, 1001 Front Street, Harrisburg, Pa.

Sept. 16-19—BOSTON, MASS. (Statler Hotel)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

Sept. 17-19—ATLANTA, GA. (Ga. School of Technology)
Annual Water & Sewage School. Sec'y, Van P. Enloe, Rt. 5, Box 363, Atlanta, Ga.

Sept. 18-20—BAY CITY, MICH.
Michigan Section A.W.W.A. Sec'y, R. J. Faust, State Dept. of Health, Lansing, Mich.

Sept. 22-24—LOUISVILLE, KY. (Brown Hotel)
Kentucky-Tennessee Section A.W.W.A. Sec'y, R. P. Farrell, 420 6th Ave., N., Nashville 3, Tenn.

Sept. 30-Oct. 1—COLUMBUS, OHIO (Deshler-Wallick Hotel)
Ohio Section A.W.W.A. Sec'y-Treas., F. P. Fischer, 812 Perry Payne Bldg., Cleveland, Ohio.

Oct. 2-3—COLUMBUS, OHIO (Deshler-Wallick Hotel)
Ohio Conference on Sewage Treatment. Sec'y-Treas., L. B. Barnes, 441 S. Prospect St., Bowling Green, Ohio.

Oct. 6-8—NIAGARA FALLS, ONTARIO (General Brock Hotel)
Canadian Institute on Sewage & Sanitation. Sec'y-Treas., A. E. Berry, Ontario Department of Health, Toronto 8, Ont.

Oct. 6-10—ATLANTIC CITY, N. J. (Convention Hall)
American Public Health Association. (75th Annual Meeting.) Exec.-Sec'y., Reginald M. Atwater, M. D., 1790 Broadway, New York, N. Y.

Oct. 8—DOVER-FOXCROFT, ME.
Maine Water Utilities Assn. Sec'y, Earle A. Tarr, Winthrop, Me.

Oct. 9-11—CEDAR RAPIDS, IOWA (Hotel Montrose)
Iowa Section A.W.W.A. Sec'y-Treas., H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.
(Joint meeting with)
Iowa Sewage Works Assn. Sec'y-Treas., Robert D. Mott, Iowa City, Iowa.

Oct. 13-15—AMARILLO, TEXAS (Hotel Herring)
Southwest Section A.W.W.A. Sec'y-Treas., L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 16-17—OCEAN VIEW, VA. (Hotel Mansemond)
Virginia Industrial Wastes & Sewage Works Assn. (First Annual Conference). Sec'y-Treas., A. H. Paessler, 815 E. Franklin St., Richmond 19, Va.

Nov. 3-5—ATLANTA, GA. (Biltmore Hotel)
Southeastern Section A.W.W.A. Sec'y, W. T. Linton, State Board of Health, Wade Hampton Office Bldg., Columbus, S. C.

Nov. 6-8—ATLANTIC CITY, N. J. (Hotel Claridge)
New Jersey Section A.W.W.A. Sec'y-Treas., C. B. Tygert, Box 178, Newark, N. J.
(Joint meeting with)
Nov. 6-8 ATLANTIC CITY, N. J. (Hotel Claridge)
South Jersey Assn. Water Supts. Sec'y, Walter Spencer, 2707 Bethel Ave., Merchantville, N. J.

Nov. 10-12—GREENSBORO, N. C. (Sedgfield Inn)
North Carolina Sewage Works Association. Sec'y-Treas., Geo. S. Moore, P.O. Box 125, Albemarle, N. C.

Nov. 17-18—ROANOKE, VA. (Hotel not selected)
Virginia Section A.W.W.A. Sec'y-Treas., W. H. Shewbridge, 708 State Office Bldg., Richmond, Va.

Nov. 19-21—WASHINGTON, D. C. (Hotel not selected)
Four States Section A.W.W.A. Sec'y-Treas., W. A. Welch, 748 Public Ledger Bldg., Philadelphia, Pa.

Nov. 20—BOSTON, MASS. (Statler Hotel)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

Dec. 10—WINTHROP, ME.
Maine Water Utilities. Sec'y, Earle A. Tarr, Winthrop, Me.

Dec. 18—BOSTON, MASS. (Statler Hotel)
New England Water Works Assn. Sec'y, Jos. C. Knox, 609 Statler Bldg., Boston, Mass.

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Here and There with Doc Symons

H.T.M.A.—And this time I'd like to editorialize a little—not too much, mind you—just a little. Not long ago the editor of this magazine wrote an editorial suggesting that the Federation of Sewage Works Assns. should have a Division of Industrial Wastes.

Now, as a fellow who has dabbled in industrial wastes for several years, that sounds like a good idea to me. Particularly, when I hear about a half dozen other organizations holding industrial waste symposiums, I agree that the Federation might well set up a Division of Industrial Wastes.

And just in case some of the boys in that organization take kindly to this idea, I've another suggestion, to wit: Take a look at those Purdue Industrial Waste Conferences for an idea. Don Bloodgood's done some mighty fine work with those meetings. Of course, I'm prejudiced when it comes to talking about Don.

* * *

In case you didn't know it, Caleb Mills Saville, Manager and Chief Engineer of the Metropolitan District Water Bureau of Hartford, Conn., is 82 years old this month. Congrats!

* * *

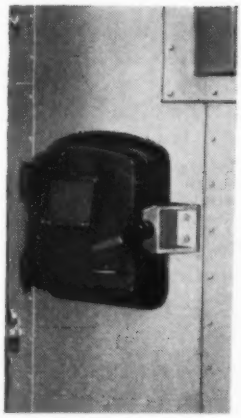
I like to see young fellows get ahead!—Paul Weir, Asst. Chief, Atlanta, Ga., Water Dept., has been elected president of the Georgia Engineering Society, and Dr. W. D. (Hap) Hatfield, Supt. of the Decatur, Ill., Sanitary District (where I first learned about sewage and industrial wastes with "Hap" as my mentor), has been made Chairman of the Decatur Planning Commission.

* * *

One Meets Such Interesting People.—Returning, on the Lake Shore Limited, from the Ill. Section meet-

Don't!

OPEN THE DOOR, RICHARD!*



No, Richard doesn't have to open the door if he's the operator of a modern Nichols MONOHEARTH Mechanically Stoked Refuse Incinerator.

Opening doors leads to a lot of back-breaking LABOR on old style manually stoked incinerators.

Let a fractional H. P. motor do the work. Make your new† refuse incinerator a MONO-HEARTH, the Modern, Mechanically Stoked incinerator.

†Or modernize your existing incinerator by installing a Nichols Monohearth cone and stoking arms.

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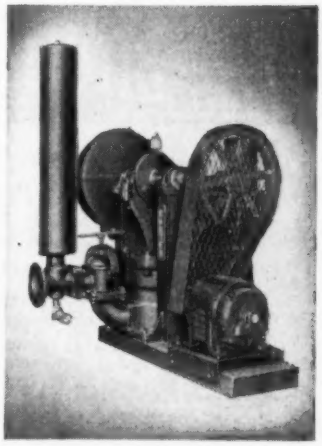

RALPH B. CARTER COMPANY
HACKENSACK, N. J.
53 Park Place, New York 7, N. Y.

ing in Chicago last month, I was seated in the diner with three ladies. They, strangely enough, had left San Francisco but a few days previous on different trains and they were discussing the city. With the July San Francisco Water and Sewage Works conferences in mind, I asked a few questions and was assured that San F. is a delightful place for a convention.

Conversation drifted to destinations and such. One elderly lady, a native of California, was on her way to New York for a visit. The second woman was on her way to join her husband, a U. S.. Army officer stationed in New Foundland. She told of flying from New Foundland and of being grounded in a Canadian village. When she said she became very thirsty in the two days she was there, I sniffed a story and asked why she hadn't had a drink of water. "Because," she replied, "the water wasn't chlorinated."

The third one of my dinner companions was an English girl returning home to Oxford after a year in this country. She, a Miss Whitnall, had spent five years during the war driving a "Tea Canteen" for the Y.M.C.A. That particular canteen (a 1937 truck with special body) had been donated to the British Y.M.C.A. by Smith College of Northampton, N. H. After 100,000 miles of driving and serving Tea for Two—Million (as she put it), Miss Whitnall had brought the canteen back to the Smith Campus and was touring the States lecturing to Smith Alumnae about "their canteen in the war." She had some fascinating stories to tell. Sniffing one for this column, I asked, "Where did you get the water for your tea?"—"From the tap!" she said.

Contrasting this with the comment of the American woman, I thought, "I've been making my speeches on Public Relations in the wrong country."—Or have I?

* * *

How many titles can a man have at one time? Just a few weeks after he became Vice-President Elect of the A.W.W.A., one Linn Harrison Enslow, an editor of these parts, as you well know, became "Grandfather" to one Robert Harrison O'Grady—9 lb.—3 oz.

* * *

When the Ill. Section presented "Cliff" Fore with the Fuller Award a statement was read in connection with the citation. When I heard it, it made me proud that I was once a water works operator. When you read it here, you'll know what I mean.—

"With the owner and also the operator of the public water supply property of the Village of Royalton, Ill., in military service, and with the assistant operator unable to be on duty because of illness, this community, representing a population of about 5000, suddenly found itself entirely without water service. No person was available locally with experience in operating the purification plant, chlorinators, pumping equipment, etc.

"Seriously deferred maintenance of equipment and complete failure of some of the units at the plant presented a problem which required immediate heroic action . . . . (the) problem was how to locate someone, quickly, capable of patching up the broken equipment, and operate it until new equipment could be obtained, and to do so with the very limited funds which could be made available for the purpose.

"Appeals were made by Royalton citizens and public officials . . . . in an effort to locate a man and equip-

ONE COAT . . . THIS THICK
TWO COATS . . . THIS THICK
THREE COATS . . . THIS THICK
THICK ENOUGH TO PROTECT SEWAGE PLANT SURFACES AGAINST ANY CORROSIVE CONDITION
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Three coats of Bitumastic #50 will cover metal, masonry or concrete surfaces with 1/16" of carefully refined heavy coal tar pitch, a protective shield with sufficient body to ward off corrosion from even the most active acids and fumes.

Each coat is equal to 8 coats of ordinary paint, but in spite of this thickness, Bitumastic #50 works easily and is applied readily with a brush. The refined coal tar pitch that forms its base is the most universally accepted protection against corrosive action.

There's a data sheet devoted exclusively to the subject of corrosion—proofing for Sewage Disposal Plants—ask for form 342. Address Wailes Dove-Hermiston, Westfield, N. J.

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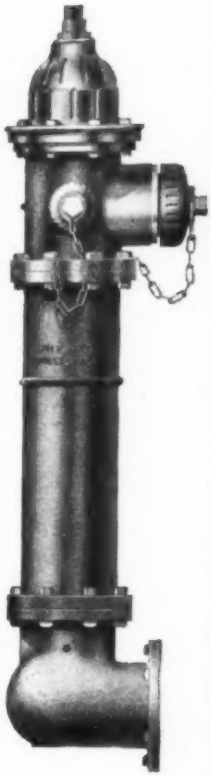

VALVES: A.W.W.A. type, iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

Hydraulically Operated: For remote control of operation and for quicker, easier opening or closing. Can be supplied in any of the standard sizes of M & H A.W.W.A. gate valves, either high or low pressure.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

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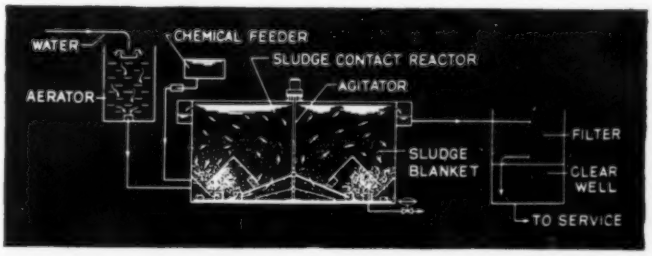
An "Iffy" Job that Requires Experienced Specialists

If iron is present without manganese
If manganese is present as well as iron
If impurities are in ferrous and manganous form
If iron is present in organic combination
If hardness also is to be removed
If water is high in alkalinity
If water is high in CO_2
If air enters the system
If pH value is low



Staining of porcelain basins, dishes and linens . . . color and bad taste of water . . . demand the elimination of iron and manganese when these troublesome impurities are present in water supply.

But how best to do it? Precipitation? Aeration? Coagulation? Filtration? Oxidizing reagents? The removal of these impurities depends on so many factors that successful treatment requires experienced specialists.

The LIQUON engineers can apply more than 30 years of such specialized experience to your particular problem. In addition, they can also supply exactly the right equipment and materials, because LIQUON service includes every process and every type of equipment for any water conditioning requirement.

A preliminary investigation and recommendations by LIQUON will not involve the slightest obligation on your part. Therefore, if your water supply contains iron or manganese . . . or any other impurity . . . consult the LIQUON engineers without delay.

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EVERY PROCESS . . EVERY TYPE OF EQUIPMENT
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ment to restore Royalton's water supply.

"When Clifford Fore of Carbondale learned of the situation, he immediately drove to Royalton, 35 or 40 miles from his city, and personally took charge of the situation. Within relatively few hours he had the water service restored to the community. This was only the beginning of the job, however. He obtained permission from his local municipal officials to be absent from his own duties for sufficient length of time to rehabilitate the Royalton plant.

"In the face of almost insurmountable difficulties, encountering one emergency after another, Clifford Fore put that plant into operating condition. For a period of almost six months he struggled with the Royalton problems, including borrowing pumps from O.C.D. and the State Highway Dept., encountering and conquering flood problems, etc. He installed a modern chlorinator, trained operating men, kept the plant running under difficulties, used his personal car to make frequent trips to Royalton, worked long hours, and at times had to do a laborer's job himself to obtain results.

"With barely enough money available to pay actual out of pocket expenses, Clifford Fore's unusual service in restoring and maintaining water service to a community to which he was not personally obligated, represents an outstanding example of unselfish devotion to the water supply profession and tradition, deserving of real recognition."

Don't you agree? Cliff, incidentally, is one of the Dual Personality Boys—Supt. of Water and Sewage Works, in Carbondale.

* * *

Water Works Romance No. 5.—J. K. Van Brundt (W&T's representative in Boston) was once a student at the Newark Engineering School. The Dean of Engineering had a secretary named Betty. I don't know how often Van was called to the Dean's office, but when he was he didn't miss seeing that lovely lass from Scotland. Married her, you know!

* * *

Beg Pardon, Sir!—In the March issue, this column told a story that had been heard from L. E. "Wick" Wickersham of Amer. Water Wks. and Elect. Co. It was a good story about the filter plant operator who said he "wasn't interested in B. Coli; it was the bacteria he worried about." Yes, it was a good story, but "Wick" wrote to say that their operators were well trained and thoroughly conversant with the differentiation of the coliform group of bacteria. By telling the story I had impugned the good names of "Wick's" operators. Actually the man who had made the statement was an old doctor in a small town in Pennsylvania, and the statement was made "about 30 years ago" when "Wick" was with the Penna. Board of Health and was investigating the water supply in that Penna. town of which the old doctor was health commissioner.

Of course, "Wick" set the old man straight—just as he set me straight, and herewith my apologies to your boys, "Wick." It *was* a good story, and recalling that "about 30 years ago" I was a filter plant operator, who didn't know anything about the differentiation of Coliform bacteria, I thought it *could* have been an operator.

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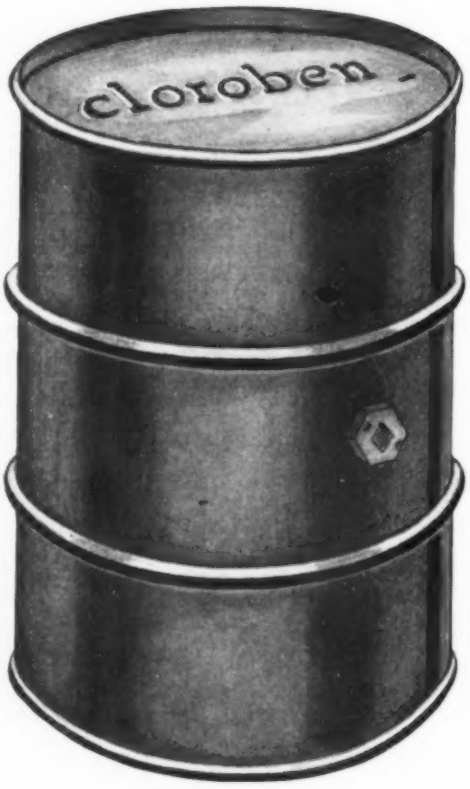
THE MODERN WAY TO TREAT SEWAGE

Cloroben Treatment is the new, easy way to control odors and bacteria in sewage. Cloroben is harmless to personnel and easy to use.

Cloroben applied up-sewer reduces bacterial slime growth and dissolves greases. Internal cleaning and maintenance of sewer lines is held to a minimum.

For prices and other information on how Cloroben can solve your sewer odor and sewer gas attack problems write



CLOROBEN CORPORATION

225 Mercer Street

Jersey City, N. J.

Ever wonder what a couple of meter salesmen looked like at a water works convention? Well, here's a couple that I caught in my camera

at the Ill. Section Meeting in Chicago in April. On the left is Ray Scheller of Pittsburgh Equitable Meter and on the right is none other than Francis Cunningham of Neptune Meter.—You're welcome, boys.

* * *

From my own state of New York, where we have a semi-licensing system for water and sewage works operators, came this letter to our circulation department—

"Please discontinue sending your magazine. Through it . . . . I got too interested in plant operation, neglected my political fences and lost my operator's job. Truly yours, L. H. F.—P. S. It is to laugh."—Somehow that doesn't strike me as funny, and it doesn't appear here for the purpose of amusing anyone—That's an editorial if I ever saw one.

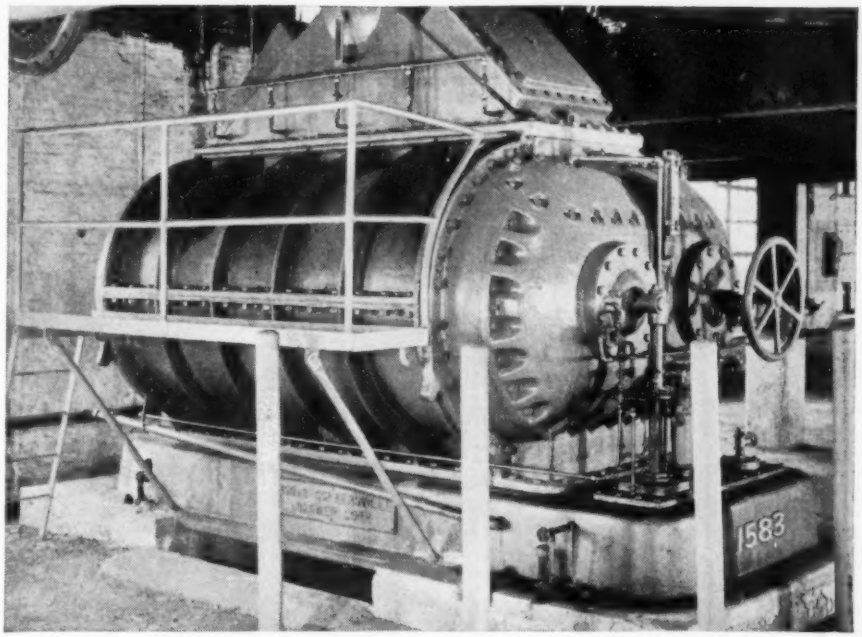
* * *

A letter from Fred (Kwik-Way Mixer) Stuart inquires, after looking at this column in the March issue, "Is your mustache getting darker?" Keep your eye on that picture, Fred, it may surprise you before too long.

* * *

Sorry Buffalo Bodie, but that special announcement I promised in December is still on ice. Maybe next month. In the meantime would you be interested to learn that not long ago I took some aptitude tests to find out what makes me tick, if anything. And what do you know—I found out I should have been a landscape gardener, safety engineer, research director, or secretary of some organization. (Remember when I was secretary of three at one time?)

I also learned that I should have been a musician, except that my finger dexterity is poor (which explains why I gave up playing the fiddle after 18 months) and my accounting aptitude is below the median (which explains why I gave up the piano after two lessons), and



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Other advantages of R-C Meters include: negligible operating cost, small space requirements and continuous, dependable performance.

For accurately measuring production, consumption or delivery of gas and for interdepartmental accounting, you can count on the cash-register accuracy of Roots-Connersville Meters. For detailed data, ask for Bulletin 40-B-14—free, of course.

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BLOWER BUILDERS R-C SINCE 1854
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my voice range is small (which explains why I can't sing), but when it comes to playing the radio, I have the perfect aptitudes.

While we're talking about my favorite subject—Me—here's another interesting fact I learned. I am the one person out of one hundred (count them) who is left-eyed and right handed and by all the rules and averages, I am, or have been a stutterer and a very nervous individual. I'm not surprised to find that I'm one of those unusual persons, for I know that I am a very unusual man in a number of ways.

For example, I breathe only half as fast as normal, there is one vertebra missing in my back bone, my blood pressure is only 108, my temperature starts at 97 in the morning and seldom reaches normal, and my basal metabolism is 30 per cent below normal—I can just hear you say—

"That guy's not unusual,—*He's* positively peculiar!"—See you subsequently, VTY. Doc.

Make Water Safe Around the Clock

Water shouldn't be half-safe nor safe only half the time. It should and *can* easily be safe 24 hours a day with the use of SOLVAY Liquid Chlorine.

You get real protection with SOLVAY Liquid Chlorine, because of its uniformity and controlled quality. Specify SOLVAY when you order your cylinders, tank cars or ton containers.

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THE SPILLWAY

[Overflow from the main section]

Steinmetz Said, "Save Niagara Falls"*

The great Dr. Chas. P. Steinmetz has been dead many years, but his good ideas go marching on. He was opposed to waste, as most engineers are. He believed in saving. One of his suggestions that this writer thought was a good one, and still thinks is good, pertained to the saving of Niagara Falls.

It was Dr. Steinmetz's contention that ALL of the water of Niagara Falls should be utilized for developing power. In that way Niagara would be dry most of the time. Although the dry Niagara would not be as much of a spectacle as the wet, still, according to Steinmetz's way of looking at it, we would have the additional pleasure of seeing it DRY. Then on special occasions the water could be allowed to flow over the falls—a sight that would be well worth seeing. Nobody living has ever seen that great volume of water suddenly let loose and allowed to flow over the falls. Dr. Steinmetz contended that it is extravagant and foolish to allow the water to go to waste as at present so long as it is possible to "both have our cake and eat it too."

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

England's River of Woe Flows Again

A Disappearing Stream Reputed to Bring Woe When it Reappears

Croyden Bourne which drains the Caterham-Valley near London is a stream that disappears and reappears. Superstitious folk know it as the "River of Woe," because its "rebirth" has almost invariably preceded or coincided with a "woe" of one sort or another. It has recently begun to flow again for the first time in nine years, and is considered by many old timers as indicative of a pending woe or disaster of some sort.

The "River of Woe" has not flowed since 1938, just before a severe typhoid epidemic in the valley took

forty-three lives. Earlier appearances were recorded during the Great Plague of 1665 and again during the first World War when each rebirth of the stream preceded some allied military reverse. Luckily for the residents of the "Valley of the Woe," the stream did not flow during World War II.

According to geologists the Croyden Bourne flows whenever the underlying sponge like chalky formation becomes saturated during periods of heavy precipitation and the ground water level rises and becomes the Bourne. This time it is expected to flow for about a month and then disappear again.

A Salesman's Dream?

"You say he's a salesman for WATER & SEWAGE WORKS magazine? Well don't just stand there Joe—that guy's got something worth selling. Throw him in!

New York State Recommends Free Residual Chlorination

In a recent issue of the Health News, issued by the N. Y. State Dept. of Health, there appears an article titled "The OTA Test and Free Residual Chlorination." This article points out that water supply officials generally have not adopted either the OTA test or the practice of free residual chlorination to the extent which seems justified. This article is speaking, of course, for chlorination practice for New York State, but it emphasizes that wider application of these modern procedures is warranted by the numerous advantages they offer.

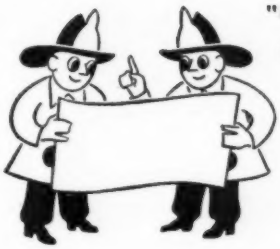
The article further points out that in many instances "it has been found that a minor increase in the dose of chlorine will result in formation of free available chlorine residual" with benefits to that type of chlorination. The use of the OTA test is therefore recommended with the chlorination of all water supplies to disclose basic information.

Quoting further from Health News, "this relatively new treatment [free residual chlorination] should be utilized more generally for the treatment of unfiltered surface supplies, especially when treated water may be stored in a reservoir or basin for two hours or more to permit such secondary actions as the control of algae, bleaching, and the precipitation of iron, manganese, and organic matter coagulated by chlorine."

"The significant fact is that free residual chlorination achieves all these benefits together with more effective disinfection, production of stable residual chlorine, and elimination of chlorinous tastes."

For these reasons the N. Y. State Dept. of Health believes that it is "important that water supply officials appraise the supplies under

WORLD'S STANDARD OF COMPARISON



"HOW DOES IT COMPARE WITH A MATHEWS?"

That is a stock question in waterworks circles, for Mathews have been the standard of comparison a long time—generations, in fact. One reason is the barrel: It contains all the working parts, and is *removable*. Suppose a Mathews should be damaged by a truck. You just unscrew the barrel and replace it with a spare—all in a few minutes. It's an *above-ground* job, with no long interruption in service, no breaking of the pavement, no digging. The end result is more protection and less cost. This is an exclusive Mathews feature.

OTHER FEATURES OF MATHEWS LEADERSHIP

Operating nut shield to keep out rain and dirt • Hydrant water cannot reach operating thread • Only one part to lubricate—and only rarely • Compression-type main valve, always seating tight • Head can be rotated 360° on a swivel flange • Replaceable head permits change in nozzle outlets • Nozzle levels can be raised or lowered • Barrel screws into bronze bushing in elbow • Free-moving protection case takes thrust of freezing earth • Positive, automatic drain valve—insuring dry barrel • A new barrel makes the oldest Mathews good as new

MATHEWS HYDRANTS

Made by R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING, INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.

Manufacturers of Sand-Spun Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

their supervision to determine how best this improved disinfecting process may be used. Higher capacity chlorinators will be needed most likely in many instances to permit the practice of free residual chlorination which offers the following advantages: destruction by oxidation of taste and odor-producing compounds; control of deleterious growths inside water mains; and the prevention of biochemical corrosion through the destruction of organisms associated with the production of organic acids or the reduction of sulphates to sulphides."

Sewer Service Charges Yield Philadelphia Neat Income

About a year ago Philadelphia adopted the Sewer Service Charge as a means of paying for its sewage works betterment and operation and maintenance of the sewerage system and treatment plants.

It is reported that collections made during the first year of Sewer Service Charges has yielded Philadelphia a neat $3,161,283 which we doubt could have been raised in any other manner. A simpler or more equitable method of deriving funds for sewerage financing, year in and year out on an assured basis, is hard to imagine.

A REVOLUTIONARY NEW DEVELOPMENT

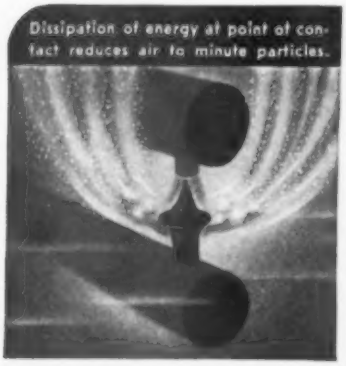
BY PROQUIP

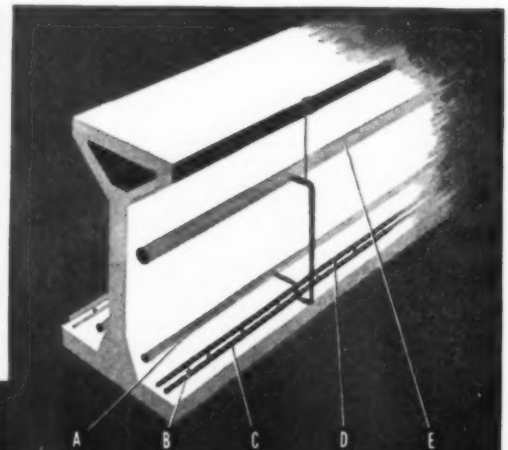
FOR SEWAGE AND WASTE TREATMENT

The Impingement Aerator

FOR THE ACTIVATED SLUDGE PROCESS

Far superior to the diffuser tube and plate systems, this advanced design offered by PROQUIP provides opposing water and air jet streams discharging against a double cone. Result — an impingement contact producing ideal aeration.





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MANUFACTURERS' and EQUIPMENT NEWS

Hammond and Dickey Vice Presidents Bailey Meter Co.

Bailey Meter has announced the election of H. M. Hammond, former general sales manager, and P. S. Dickey, former chief engineer, as vice presidents of the company.

Mr. Hammond, a graduate of Renssalaer Polytechnic Institute, joined the company as a field engineer in 1919. Mr. Dickey, a graduate of Purdue University, has been associated with the company since 1925.

New Ribbed Gasket

A. P. Smith Manufacturing Co. has developed a new lead gasket having raised, preformed ribs. This gasket is for use on bolted tapping sleeves and covers the full length and width of the flange.

When the sleeve halves are assembled on the main, the raised ribs are compressed first, after which the balance of the gasket is compressed. This action assures a permanently tight, leak-proof sleeve assembly, free from strains and distortion.

The new gasket will be furnished with all Smith bolted tapping sleeves. For additional information write the A. P. Smith Manufacturing Co., East Orange, N. J.

Frank Macdonald Becomes Sales Mgr., Electro-Rust-Proofing Corp.

The Electro Rust-Proofing Corp. of Belleville, N. J., now a wholly owned subsidiary of Wallace & Tiernan Co., has announced the appointment of Frank P. Macdonald as sales manager. Mr. Macdonald has been

Frank P. Macdonald

with Electro Rust-Proofing for a number of years and in this service has acquired a wide experience and many friends in the field of cathodic protection as it is applied to water and sewage works structures and equipment.

Mr. Macdonald will make his headquarters in the Wallace & Tiernan Building at 1229 West Washington Blvd., Chicago.

Kwik-Way Mixer

The Stuart-Brumley Corp, has announced the availability of the overhead drive, Kwik-Way Mixer. This new mixer, which operates on an entirely new principle, has been in operation in the field for two years at Norfolk, Va., and Portsmouth, Va. On the basis of the results obtained in those installations, the equipment is now being released to the public.

With this overhead drive mechanism, there are no bearings under water and all moving parts are above water. The slotted inverted V-baffles which move vertically create a thorough mixing, distribute the floc evenly, and produce a granular floc in from five to ten minutes.

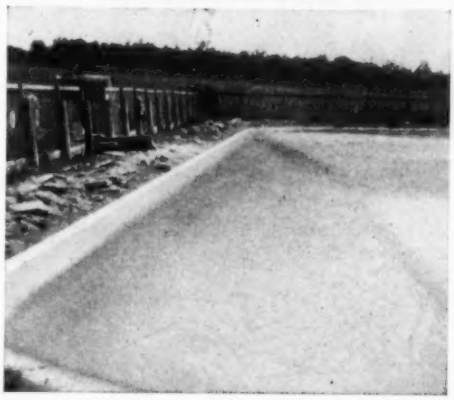
These Kwik-Way Mixers can be installed in existing mixing or settling basins.

Further information on the details of the Kwik-Way Mixer may be obtained from Stuart-Brumley Corp., 516 N. Charles St., Baltimore 1, Md.

CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.



NO MAINTENANCE IN 22 YEARS

The before and after photos show a reservoir we re-lined with "GUNITE" in 1925 for the Village of East Aurora, N. Y. Recently Mr. V. E. Haemmerlein, Village Engineer, wrote us:

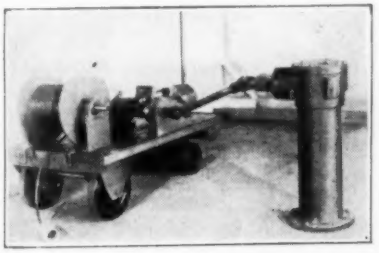
"The job you did of Guniting our reservoir is still in first class condition. Some hair cracks have developed near the top. I drilled one-half inch holes where some of these cracks showed but find that they are only about one inch deep. They do not go beyond reinforcing. We have had no maintenance whatsoever."

We can similarly solve your problem if you have an old, leaky or disintegrated reservoir. We invite you to call on us for complete information, recommendations or estimates on any "GUNITE" work which you may be planning.

Our 72-page bulletin C 2300 describes this job and scores of other profitable uses of "GUNITE." Write for your free copy today.

PAYNE DEAN GATE OPERATOR

ONLY TWO MEN TO OPERATE YOUR LARGEST GATES. CUTS OPERATING TIME 80% -- NO BREAKAGE OF PARTS -- FITS ONTO YOUR EXISTING TRUCK -- FOR OPERATING GATES FROM 12" TO 60".



PORTABLE MOTOR OR GASOLINE OPERATOR FOR FLOOR STAND OPERATED SLUICE GATES AND UNDERGROUND GATES.

PAYNE DEAN & CO., MADISON, CONN.

Heat Recovery Boiler and Snubber

The Burgess-Manning Co. of Chicago has developed a special combination exhaust heat recovery boiler and snubber. Designed in the conventional 3-chamber side inlet construction, consisting of one boiler section and two snubber sections, this new unit has improved vertical fire tube boiler allowing for ease in cleaning. The boiler size is based on a tube area of approximately one sq. ft. of heating surface to 7 BHP for 4 cycle engines, and the ratio for 2 cycle engines where exhaust temperatures are generally lower becomes one sq. ft. of heating surface to 3 or 4 BHP.

Heat recovery in these units is estimated at 1 Btu. per BHP per degree F. exhaust gas temperature per hour. This equipment should be of interest to persons employing diesel engines where snubbing of the exhaust and recovery of heat are operation problems.

Further information on this combination exhaust heat recovery boiler and snubber may be obtained from Burgess-Manning Co., 2815 W. Roscoe St., Chicago 18, Ill.

PICK UP
Wasted Dollars
with the Royer Sludge Disintegrator

Prepare salable sewage sludge for less than cost of burying, incinerating, or hauling to a fill—sell it and convert expense to revenue. Sewage plants everywhere are installing Royer Sludge Disintegrators to reduce their operating expenses and to help their community to have better crops, shrubs, and flower gardens. All sludge is rich in nitrogen; digested or activated it's also rich in prosphoric acid and potash—that's why, properly prepared, it's in demand. Fast, ideal preparation is assured with the Royer—just shovel in sludge from drying beds and machine does the work. It shreds to uniform, pea size; removes sticks, stones and other trash; reduces moisture content; aerates; discharges direct to pile, bags, or truck. Many models—send for Bulletin 643.

Royer Model NSC-4 at Syracuse, N. Y. 6 to 8 cu. yds. per hour capacity.

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.

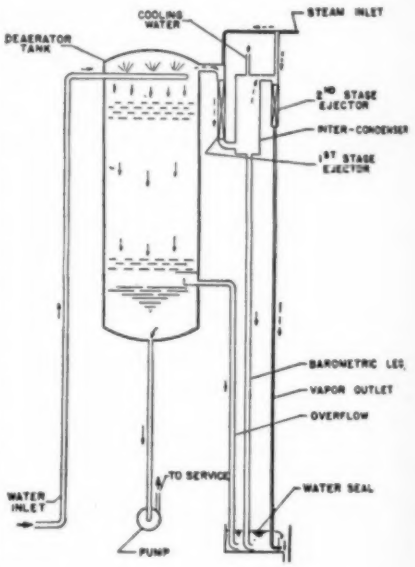
R. E. Reimer, Vice Pres. Dresser Industries

Rudolph E. Reimer, Secretary and Treasurer of Dresser Industries, Inc. has been elected a vice president of the company. Mr. Reimer has been associated with the Dresser Industries since 1929, when he became controller of the Dresser Manufacturing Co., Bradford. He was elected secretary-treasurer of Dresser Industries, Inc. in 1943.

As a top Dresser executive, Mr. Reimer is an officer and director in many of the Dresser units, including the Dresser Manufacturing Co., Pacific Pumps, Inc., Clark Bros. Co., Inc., Stacey Bros. Gas Construction Co., and Roots-Connersville Blower Corp. among others.

Vacuum Deaerator

The Liquid Conditioning Corp. of Linden, N. J., has announced a new Liquon Vacuum Deaerator for the purpose of removing oxygen and other dissolved gases from cold water in order to prevent corrosion at low temperatures.



The unit consists essentially of a chamber in which the water is broken up into thin sprays and films to permit the release of the dissolved gases under a vacuum. The vacuum may be created by steam by means of a two stage ejector with an intercondenser between, or it may be maintained by a vacuum pump.

Complete information on this Liquon Vacuum Deaerator may be obtained from the Liquid Conditioning Corp., 114 East Price St., Linden, N. J.

OMEGA

CHEMICAL FEEDERS with DUST REMOVERS

Hopper filling and chemical feeding are dustless operations when you use OMEGA Feeders equipped with OMEGA Dust Removers. Dusty air is drawn through filter bags while the hopper is being filled and all the collected chemical dust falls — without waste — into the feed hopper below. Since the feeding mechanism is enclosed in a dustproof case, sealed on the mixing chamber, the dust nuisance is entirely eliminated and plant housekeeping is simplified.

The OMEGA Universal Feeder shown with Dust Remover is a rugged volumetric feeder for accurately feeding all dry materials including lime, soda ash, alum, Ferrisul, Ferrifloc and carbon. It handles lumps or powder without clogging and is famous for long, trouble-free service. Three sizes for feeding from 1 to 6,000 lbs. per hr.

Write for bulletin.

OMEGA PRODUCTS

VOLUMETRIC FEEDERS • GRAVIMETRIC FEEDERS • SOLUTION FEEDERS • LIME SLAKING EQUIPMENT • BUCKET ELEVATORS LABORATORY STIRRERS

OMEGA MACHINE CO.
(Division of Builders Iron Foundry)
19 DODDING ST., PROVIDENCE 1, R. I.

LeMieux Made V.P. Fibre Conduit

Bernard G. LeMieux has been made a vice president of the Fibre Conduit Co., manufacturers of Orangeburg fibre conduit sewer pipe.

Mr. LeMieux was formerly plant manager, having joined the firm in 1930 as assistant plant manager. In 1936 he was plant engineer, in '37 chief engineer, and in '39 became director of research. In 1945 he was made plant manager.

E. L. Berry, Link-Belt Vice-Pres., Dies

E. L. Berry, vice-president in charge of production of the Link-Belt Company, Chicago, died suddenly early in April. Mr. Berry began his Link-Belt career in 1914 as a machinist. He became vice-president of the parent organization on January 1, 1944.

Frank Gerlitz Simplex Valve Sales Mgr.

Announcement has been received that Frank E. Gerlitz, Jr. was appointed sales manager of the Simplex Valve & Meter Co. of Philadelphia. Mr. Gerlitz first joined the company in 1941, serving in the capacity of

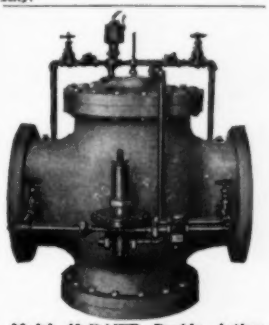
sales consulting engineer. In 1946 he was made assistant sales manager.

Prior to his connection with the company, Mr. Gerlitz was a designing engineer in municipal water and sewage treatment plants and was also associated for several years with the Pennsylvania State Board of Health.

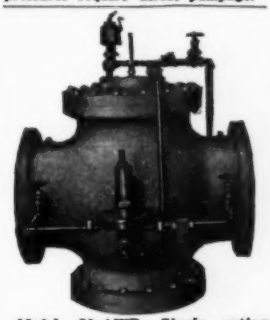
Est. 1879

ROSS AUTOMATIC VALVES

Altitude Valves for tank and reservoir, with two sets of controls—Automatic Hydraulic and Electric Remote Control. Hydraulic pilot normally operates the valve, while electric pilot is used for emergency only.



Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require direct pumpage.



Model 30-AWR Single acting valve may be controlled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

ROSS VALVE MFG. CO.
Incorporated
P.O. BOX 595, TROY, N.Y.

Penn Salt Has New Inorganic Maintenance Cleaner

A new cleaner, designated as Pennsalt MC-1, is designed for heavy maintenance work around industrial plants. A granular, inorganic material, it dissolves quickly in water, removes most types of soil easily, and rinses rapidly. It is not a soap and it is not necessary to use a soap with it.

Pennsalt MC-1 is designed for cleaning walls, floors, woodwork or windows, for general purpose janitor cleaning, and for industrial washing machines, etc.

Pennsalt MC-1 can be used for metal preparation where a heavy duty cleaner would be too strong. The new cleaner is mild enough not to harm either clothing or skin, and acts as a water conditioner and soap saver.

It may be obtained in 125 or 250 pound plywood drums. A four-page leaflet describing Pennsalt MC-1 may be obtained by writing the Pennsylvania Salt Co., 1000 Widener Bldg., Philadelphia 7, Pa.

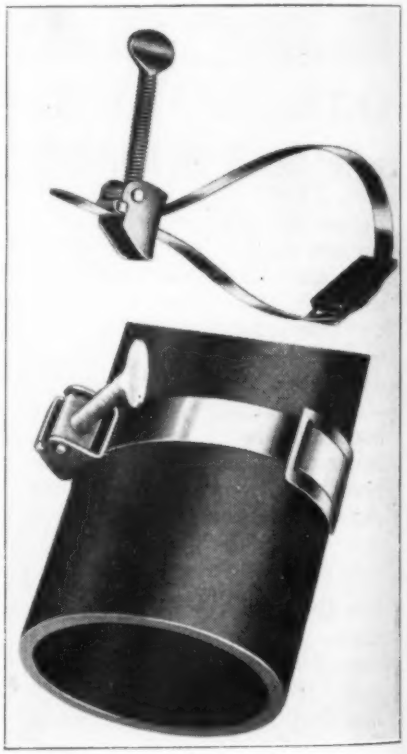
E. F. Schaefer New President Gardner-Denver

Edgar F. Schaefer, executive vice-president of the Gardner - Denver Co., has been elected president, and H. G. Myers, former president, became chairman of the executive board at a recent stockholders' meeting.

In assuming chairmanship of the executive committee, Mr. Myers takes the post formerly held by the late J. W. Gardner. Mr. Myers joined the company in 1927 as chief engineer, and Mr. Schaefer joined the company in July 1919.

Patchmaster Pipe Leak Clamp

A new all-purpose pipe leak clamp called the *Patchmaster* has been announced by Marman Products, Inc., of Inglewood, Calif. The Patchmaster, which is a permanent



method of sealing pipe leaks, is designed to stop leaks on low or high pressure pipe ranging in size from ½ in. to 4 in. in diameter. It consists of a corrosion-resistant stainless steel Marman Universal clamp and a specially designed patch plate of stainless steel annealed sheet which naturally forms to pipe contour, and a Hycar oil-resistant pad. Four sizes are obtainable to handle all pipe diameters up to 4 inches.

For further information write Marman Products Co., Inc., 940 W. Redondo Blvd., Inglewood, Calif.

Before You Buy ANY Domestic Water System
See the PEERLESS Water King Advantages!

Exclusive Water King Features
SIMPLIFY WATER PUMPING—LOWER COSTS

The Most Advanced Pumping Principle in the Last 10 Years

"Magic Wings to Water Lift"

The trouble-free simplicity of the patented Peerless Water King is a real innovation in water pumping. Here is the ideal pump for domestic and light industrial water systems, meeting every requirement for simplified pumping at lower costs.

The Peerless Water King is the pump with "Magic Wings to Water Lift." The Water King is a shallow well pump, embodying an exclusive "magic" pumping element: a hard chrome rotor revolving in a rubber stator that draws water upward and forces it into pressure tank—the most advanced pumping principle in the past 10 years. Capacities: 275 to 860 g.p.h., against pressures up to 40 lbs. *There are no parts of the pump underground.* 100% automatic. Easily installed over the well or offset. Pumping element highly resistant to abrasive and corrosive action. Finely engineered—Compact—Quiet—Trouble-free.

PLAN WITH PEERLESS

Peerless has a pump for all your needs for water—from 10 to 220,000 gallons per minute! Write to Peerless factory or district office for literature and name of nearest dealer. *Descriptive Bulletins available.*

PEERLESS PUMP

THE PEERLESS WATER KING

Covered by Peerless Patent 2,346,428 Mfd. under R. Moineau's U. S. Letters Patents 1,892,217-2,028,407—Reissue 21,374 and Canadian Patent 352,574; Robbins & Myers, Inc., Sole U. S. and Canadian Licensee.

2 PEERLESS DOMESTIC WATER SYSTEMS

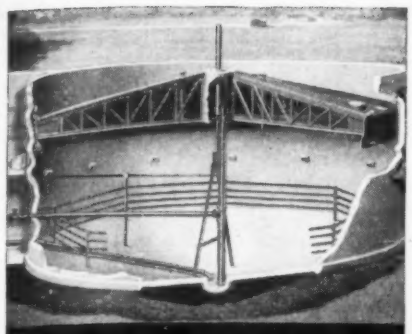
A PEERLESS JET SYSTEM, TOO

For Deep or Shallow Wells. Capacities: 120 to 7500 g.p.h. Lifts up to 120 feet.

This amazingly simple and compact Peerless Jet Water System produces all the water you want for normal light industrial operating requirements. It is a pressure system, entirely automatic, and occupies little more space than an electric motor. A Peerless Jet Water System offers a lifetime of trouble-free water service at minimum cost. Can be installed over well or offset.

Write for Bulletin B-155-1 describing Jet Water System in detail.

PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
Factories: Canton 6, Ohio Quincy, Illinois Los Angeles 31, California
District Offices: Canton 2, Ohio; Ardmore, Pa.; Decatur, Ga.; Dallas 1, Texas



P.F.T. Supernatant Selector

provides a positive means of selecting and removing the best supernatant liquor from digestion tanks at a slow, continuous rate, regardless of location of supernatant in tank. Vertical slotted tube of selector extends through all zones where strata of supernatant form. Effective capacity of the tank for the reduction of solids is increased. Rate of withdrawal can be controlled within fairly close limits with the P.F.T. Supernatant Gauge, Sight-Glass and Sampler. Ask for Bulletin No. 243.

P.F.T. PACIFIC FLUSH TANK CO.
4241 RAVENSWOOD AVE., CHICAGO
NEW YORK • CHARLOTTE, N. C.
SAN FRANCISCO • LOS ANGELES

RENEW Water Meter Accuracy

Dissolve Costly Scale Quickly with

NU-COIL

Makes Meters Function Like New!

NU-COIL removes lime scale and water solids in a jiffy . . . cuts through sludge and flint-like deposits efficiently. NU-COIL is designed to protect light metals . . . precision fittings . . . rubber bushings and porcelain meter faces.

NU-COIL is mild, easy to handle . . . leaves no choking fumes.

1. Easy to Use
2. QUICK Acting
3. No Disagreeable Odor
4. Efficient
5. Economical

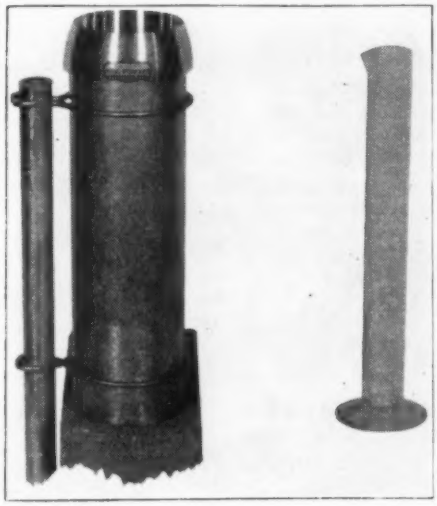
SKASOL CORPORATION
116 Glencoe Ave. • Webster Groves 19, Mo.
Send for FREE Descriptive Folder

Universal Rain Gage

M. C. Stewart of Ashburnham, Mass., has introduced the Stewart Universal Rain Gage, a versatile, low cost, precision instrument for measuring precipitation in all forms whether it be rain, snow, sleet, or mixtures.

Because of its unique design and standardized parts, many different instrumental assemblies can be made up by the user to meet a variety of individual requirements.

The interchangeable parts include orifice, collector can, support ring brackets, glass graduate, coupling



unit, double depth collector can, triple depth collector can, and connection tubing.

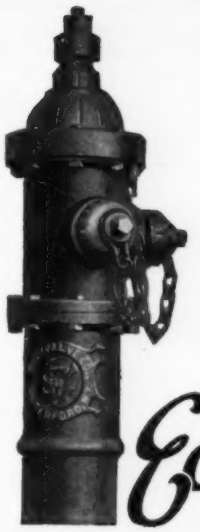
The basic Rain Gage, in simple form, consists of the orifice, collector can, support ring brackets, and glass graduate. From the component parts listed above, other types of gages can be assembled including snow gages, heated rain or snow gages, remote indicating gages, accumulator type rain gage, etc.

Practically every water and sewage works plant in the country should have a Rain Gage and this new style offers the opportunity to obtain such at reasonable cost.

For further information write to M. C. Stewart, Ashburnham, Mass.

Dickey Builds New Plant

W. S. Dickey Clay Manufacturing Co. is building a new $1,500,000 plant at Pittsburg, Kansas. The new plant will be capable of producing pipe in sizes from four inch to thirty-six inch, and the total volume is expected to be 60,000 tons annually. Twelve dryer rooms will occupy a building 640 by 126 ft. There will be thirty periodic kilns and one tunnel kiln, all fired by gas.



Eddy
HYDRANT

SIMPLE, EFFICIENT and DURABLE . . .

NO digging; no special wrenches; no water can escape in case of damage to standpipe; stem set at bottom of valve means bending by accident won't hurt it; no freezing due to positive drip action; no complicated mechanism, one man can remove entire valve and stem easily, quickly; no water hammer, valve closes against pressure with cut-off under valve; large waterway; and—every single part made with extreme care to last a lifetime and longer. Choice of many water works men and fire chiefs.

EDDY FOR LONG SERVICE

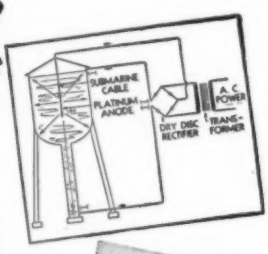
EDDY VALVE COMPANY
WATERFORD, NEW YORK

for CONCRETE and STEEL!

Inertol Protection Means Lowest Cost Per Year

INERTOL COMPANY, INC. NEWARK 5, NEW JERSEY and SAN FRANCISCO 7, CALIFORNIA

RUSTA RESTOR REDUCES TANK MAINTENANCE



Modern, Proved Cathodic Method Provides Lasting Protection Against Rusting—Eliminates Both the Loss of Service, and Cost, of Interior Painting.

Your tanks can get lasting protection against rusting with Rusta Restor. Approved and endorsed by national and state authorities, Rusta Restor reverses the electro-chemical process that causes rusting,—keeps the tank in a "neutralized" state that prevents rusting. Inexpensive to install, and cheap to operate. Send for full details today.

RUSTA RESTOR
A DIVISION OF
THE JOHNSTON & JENNINGS COMPANY
853 ADDISON ROAD • • • CLEVELAND 14, OHIO

AMERICAN GAS BOILERS
STEAM AND WATER TYPES
for Digester Heating

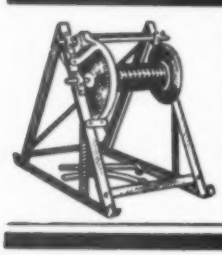
FOR RATINGS AND DATA SEE OUR PAGE IN THE 1946 ANNUAL REFERENCE SECTION

American Radiator & Standard Sanitary Corporation, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING PLUMBING
Serving the Nations' Health and Comfort

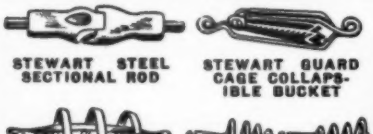
SALES OFFICES IN PRINCIPAL CITIES

Your PIPE CLEANING PROBLEMS SOLVED



STEWART STANDARD WINDLASS

Frame. Sturdy angle iron construction. Cable drum holds 1100 ft. of 3/8" cable. Shipping weight without cable 250 lbs.



STEWART STEEL SECTIONAL ROD

STEWART GUARD CAGE COLLAPSIBLE BUCKET

NO. 9A STEWART WELDED ROOT CUTTER

NO. 11—SCREW
NO. 22—SPEAR
SCREW

For information write for catalog.

Canadian Distributors: W. H. Cunningham & Hill Ltd., Toronto.

W.H. STEWART

1051 SOUTH CLINTON ST.
SYRACUSE, N.Y.

Biggs Manages G-E's Construction Engineering Division

L. M. Biggs has been named manager of the General Electric Co., Construction Engineering Division. Mr. Biggs, who has been assistant manager of that division, succeeds C. M. Rhoades who retired April 1, after 37 years with the company.

The new manager joined General Electric in 1923 and has been a member of his present organization for the past 21 years.

"Bill" Lovejoy Joins Liquon Corp.

To Be Florida Representative

Liquid Conditioning Corp. of Linden, N. J. has announced the appointment of William O. Lovejoy as its representative in Florida. Mr.

Lovejoy will handle the sale of Liquon equipment and Liquonex material.

Mr. Lovejoy has for many years been superintendent in charge of the filtration plant of the Louisville, Ky. Water Works. His new headquarters are at 1366 Holmesdale Road, Jacksonville 5, Fla.

New Vitrified Clay Sewer Pipe Plant

The Texas Vitrified Pipe Co. expects to complete their new plant for the production of vitrified clay sewer pipe in July, considerably ahead of schedule. This plant was erected after four years of testing southwestern clays to determine a deposit which would make the best pipe, and the company was incorporated at Mineral Wells, Texas, by officials of the Cannelton Sewer Pipe Co. of Cannelton, Ind., together with local Mineral Wells capital.

Preliminary tests made of the pipe from the 63 acre deposit show that the pipe will far exceed the standards of the ASTM. The plant will have an annual capacity of 20,000 tons and the deposit is large enough to last for 500 years.

Bailey Meter Assigns Field Engineers

Three new field engineers have been assigned to the Bailey Meter Co. branch offices. R. L. Stewart, graduate of Iowa State College, will be located in the Denver office; L. E. Bartel, graduate of the University of Minnesota, will be located in Kansas City, and G. D. Williams, graduate of Worcester Polytechnic Institute, is assigned to the Atlanta office.

All of these men served as naval officers during the war and joined the company after their discharges. They recently graduated from the Cadet Engineering Course at the Cleveland factory office of the company.

Columbia Chemical Makes New Appointments

W. T. Johnson in New York
G. W. Green in Chicago

W. I. Galliher, executive sales manager for the Columbia Chemical Division of Pittsburgh Plate Glass Co., has announced the appointment of Walter T. Johnson as New York

W. T. Johnson

district sales manager, and Glenn W. Green as Chicago sales representative.

Mr. Johnson has been with the company since 1930, and Mr. Green just recently joined the company. Prior to the war, Mr. Green was laboratory superintendent of the Duquesne Light Co. in Pittsburgh, and was superintendent of water and sewage at Camp Detrick, Md., during the war. Mr. Johnson has been manager of Columbia's Chicago district sales office for three years prior to coming to New York.

Ross Burns Rockwell Pacific Coast Representative

Announcement has been made by the Rockwell Manufacturing Co. that Ross J. Burns, sales engineer, formerly connected with the Chicago office of the Pittsburgh Equitable Meter Division, has been transferred to the Pacific Coast and will have his headquarters in the San Francisco branch office.

Starting in the plumbing and heating supply business, Mr. Burns later handled equipment for the water utilities. For the past six years he has been specializing in water meter sales for the Pittsburgh Equitable Meter Division of Rockwell throughout the midwestern and eastern part of the country.

Milton Roy Sheen Dies

Milton Roy Sheen, president and co-founder of the Milton Roy Company, pump manufacturers, died at the age of 63. A native of Pennsylvania, and widely known as an inventor, Mr. Sheen had designed the chemical pumps made by his firm. He had also designed a diving bell, tunnel machine, and a clam shell excavator.

Robert T. Sheen has been elected to the presidency of the company.

A National engineer arrived on the job with his service car at 8 A. M., cleaned 1,800 feet of 10 inch cast iron pipe and returned to his base before noon of the same day. This job, performed for a large industrial plant, illustrates the speed with whieh pipes can be cleaned by National. Forty years of experience enables the National Water Main Cleaning Co. to clean any water main quickly, with a minimum of interruption to service and a minimum of labor.

NATIONAL WATER MAIN CLEANING COMPANY
50 CHURCH STREET, NEW YORK 7, N. Y.

ATLANTA.....1221 Mortgage Guarantee Building
BOSTON.....115 Peterboro Street
CHICAGO.....205 West Wacker Drive
HOUSTON.....2518 Grant Street
KANSAS CITY.....421 B.M.A. Building
LOS ANGELES.....448 South Hill Street
MEMPHIS.....822 Dermon Building
OMAHA.....3812 Castellar Street
RICHMOND.....210 East Franklin Street
ST. LOUIS.....7103 Dale Avenue
SALT LAKE CITY....149-151 W. Second South Street
SAN FRANCISCO.....681 Market Street
MONTREAL.....2028 Union Avenue
WACO.....P. O. Box 887
WINNIPEG.....576 Wall Street
HAVANA - MAYAGUEZ, PUERTO RICO - BOGOTA - CARACAS - MEXICO CITY

HYDRO-TITE

FOR IMMEDIATE DELIVERY AND PERMANENT JOINTS

Hydro-tite, the self-sealing, self-caulking, jointing compound can be supplied promptly in any quantity at any time from our warehouse stocks strategically located throughout the United States and Canada. Over thirty years of use has proved that pipe joints made with Hydro-tite, stay tight. Send for data book and sample.

ALWAYS USE FIBREX

The sanitary, bacteria-repellent paper packing that is used like braided jute. Seventy pounds of Fibrex takes the place of one hundred pounds of braided jute, with proportionate savings in cost. Send for sample.

HYDRAULIC DEVELOPMENT CORPORATION
Main Sales Office: 50 Church St., New York, N.Y.
Works: West Medford Station, Boston, Mass.

H. S. Elder Named Vice-Pres. of Titeflex

Titeflex, Inc., Newark, N. J., has announced the appointment of Henry S. Elder as its vice-president. Prior to joining the Titeflex organization, Mr. Elder was assistant treasurer and a director of National Fireworks, Inc.

Titeflex products include all metal flexible tubing, equipment for aircraft, radar connection, and industrial filters of the rotary vacuum type.

Yeomans Bros. Now Offering the "Aero-Filter"

Yeomans Brothers Co. of Chicago, manufacturers of pumps and other water and sewage works equipment, announce that they have been licensed to handle the "Aero-Filter" under the Halvorson-Smith patent and are now offering this high-rate sewage filter to the sewage and industrial waste field.

Information on the new license arrangement appears in the March 1947 issue of The Yeomans Guard published by Yeomans Brothers Co.

LEADITE

The Pioneer Self-Caulking Material for C. I. Pipe

TABLE OF COMPARATIVE QUANTITIES

Nominal inside dia. of pipe, in.	Depth of joint, inches of Leadite	Approx. lbs. of Leadite per joint	Depth of joint, inches of lead	Approx. lbs. of lead per joint
4	2.5	2.00	2.25	8.56
6	2.5	3.00	2.25	11.71
8	2.5	4.00	2.25	14.63
10	2.5	5.00	2.25	17.70
12	2.5	6.00	2.25	20.86
14	2.5	7.00	2.25	24.02
16	2.5	8.25	2.25	33.07
18	2.5	9.25	2.25	36.88
20	2.5	10.50	2.25	40.71
24	2.5	13.00	2.50	53.02
30	2.75	16.00	2.50	65.36
36	2.75	19.00	2.50	77.96
48	3.50	30.00	3.00	121.15
54	4.0	38.00	3.00	135.60
60	4.0	42.00	3.00	150.70

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

Leopold

- ***GLAZED FIRE CLAY TILE FILTER***

  Non-corrosive, permanent.

- ***DRY CHEMICAL FEEDERS***

  Compact, light in weight, durable, accurate. Sizes and capacities to suit any operating requirements.

- ***COMPLETE WATER TREATMENT AND FILTER PLANT EQUIPMENT***

  Designed and built by Leopold engineers to handle any service.

Write today for complete information.

F. B. LEOPOLD CO., INC.
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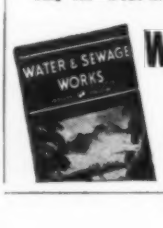
TO LAST YEAR'S ADVERTISERS

Your last year's Ad is still being seen in the Annual Water & Sewage Works' Reference and Data issue. Check for yourself. You're almost sure to find a well worn copy on your water and sewage man's desk or book shelf. Why! Let this general Superintendent tell you.

"In our dept. the annual Reference & Data Issue of Water & Sewage Works is in constant use. Considerable time and money have been saved by reference to the many tables, charts, articles, tips, gadgets, engineering construction, maintenance and operation information, as well as a wealth of advertisements in these issues."

So reserve space now for the big July, 1947, issue which covers **both** the Amer. Water Works and Sewage Works conferences.

Closing Dates
June 1st—REFERENCE & DATA SECTION
July 1st—DISPLAY ADVERTISING



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IT'S easy the Oakite Way. All you do is spread fast-working Oakite Composition No. 71 on areas to be cleaned. This granular material quickly goes into immediate action . . . completely soaks up water, oil, grease and other slippery deposits. Actually dry-cleans floors . . . leaves them safe to walk on. When "71" has soaked up slippery deposits, simply sweep particles away.

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Technical Representatives in Principal Cities of U. S. & Canada

OAKITE

Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

LITERATURE AND CATALOGS

Data Book for Engineers

If you are a consulting engineer, an architect, or a superintendent of a water or sewage works you should have a copy of the **Westinghouse Data Book for Architects and Engineers, 1947-1948.**

In the preparation of this 364-page book, special attention has been given to the inclusion of typical specifications in a manner that will be useful to architects and engineers. The treatment of each piece of equipment has been arranged to include all the information under the following headings: Application, Distinctive or Outstanding Design Features, Methods of Selection, Dimensions, Typical Specifications, and Engineering Data.

In addition to the above information, there are more than 100 pages of engineering data on product application and distribution systems design. The book also contains a complete reprint of the A.I.E.E. Manual on Electric Power Distribution for Industrial Plants.

Engineers, architects, and plant superintendents may obtain a copy of this valuable Westinghouse Data Book by writing directly to the Westinghouse Electric Corp., 511 Wood St., P. O. Box 868, Pittsburgh 30, Pa. Extra copies may be obtained for $5 per copy.

Pipe Tools

You probably haven't thought much about it before, but how could your waterworks get along without pipe tools? For that matter, how could your sewage works get along without pipe tools? Any person who has spent any time in either a water plant or a sewage treatment plant knows that there comes a time when in the process of maintenance and operation there is work to be done on pipes of all sizes, and there *are* pipes of all sizes in water and sewage plants.

When you stop to think of it, no water or sewage plant can be without its quota of pipe wrenches, pipe threaders, pipe cutters, ratchet dies, or pipe vises. A catalog which describes all of these tools is published by The Ridge Tool Co. of Elyria, Ohio. The catalog is titled **Ridgid Pipe Tools** and contains information on all of the items one might need for the proper maintenance and operation of a water or sewage plant.

Of particular interest is the Ridgid pipe wrench which has a unique design, guaranteed against ever breaking or distorting. Even the Stillson wrench has been improved on by Ridgid, and the company has developed a LonGrip pipe and screw extractor, as well as yoke and chain pipe vises, pipe cutters, threaders, compound leverage pipe wrenches, strap wrenches, pipe reamers, etc.

To make sure that you have all of the pipe tools needed for your maintenance department, we suggest that you write The Ridge Tool Co., Elyria, Ohio for a copy of this catalog showing the various types of equipment available.

FOR SERVICE... SPECIFY
GLAUBER GROUND KEY WORK

AVAILABLE FOR PROMPT SHIPMENT

K-1000 Illustrated is the Glauber specification Red Brass cap pattern stop and drain. Designed with flat way, inside iron pipe threads, and full opening lifetime lubricated valve. Furnished with loose tee or lever handle. Sizes from ¼" to 2"

Profit now from our ability to deliver quality brass ground key work in sufficient quantities to meet current building demands. Benefit in the future from long years of trouble-free service. For modern installations specify Glauber Red Brass ground keys and stops.

THE Glauber BRASS MFG. CO., Kinsman, Ohio
Division of H. B. SALTER MFG. CO., Marysville, Ohio

Glauber RED BRASS
GROUND-KEY CURB and CORPORATION STOPS
LEAD GOOSENECKS and WATERWORKS FITTINGS

Micro-Photography

In the April, 1947 issue of the **Taste and Odor Control Journal,** published by Industrial Chemical Sales Div. of West Va. Pulp & Paper Co., there appears an article on *Micro-Photography* by Paul P. Merkel, Chief Chemist of the Dept. of Public Safety, Reading, Pa. In this article, Mr. Merkel presents a number of actual photographs of microorganisms causing tastes and odors. What started out as a hobby developed into a very important aspect of taste and odor control, and the pictures which Mr. Merkel shows are of particular interest to all waterworks men plagued with taste and odor problems caused by algae.

Copies of the Taste and Odor Control Journal may be obtained from Industrial Chemical Sales Division, 230 Park Ave., New York, N. Y.

Water Main Joints

The Atlas Mineral Products Co. of Mertztown, Pa., has issued an 8-page bulletin on **Tegul-Mineralead and Hyde-Ro Rings for Jointing Bell and Spigot Water Pipe.** In addition to a listing of the advantages of Tegul-Mineralead, the bulletin shows by photographs just how the Mineralead joint is poured in a water main.

The book also contains directions for using Tegul-Mineralead information on yarning, pouring, pouring wet-joints, backfilling, etc.

Two pages of the bulletin are devoted to the Hyde-Ro Ring, a rubber ring packing substitute for jute or oakum in cast iron bell and spigot pipe joints. The advantages of the Hyde-Ro Ring and its prevention of recontamination and its ability to be easily sterilized are discussed. Pictures are shown of the method of using this ring and of other accessories.

This new bulletin may be obtained by writing the Atlas Mineral Products Co., Mertztown, Pa.

Liquid Level Controls

Catalog No. 147, published by the B/W Controller Corp., Birmingham, Mich., presents the company's complete line of **Liquid Level Controls.** These controls are floatless and operate entirely on an all-electrical principle. The bulletin describes the principle and operation of the B/W All Electric, Floatless Controls, Relays, and other equipment.

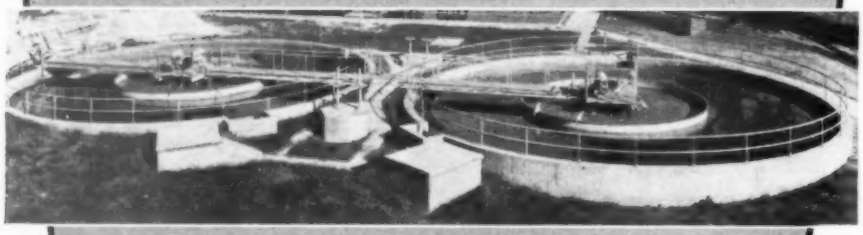
In addition to a discussion of operation, the bulletin also contains information on induction relays, multiple pump controls, electrodes and electrode holders, magnetic contactors and starters, combination starters, ice free control, and application diagrams.

Of particular interest to water and sewage works operators are the items of equipment which electrically maintain level control in standpipes, elevated tanks, reservoirs, settling basins, etc. Multiple pump controls are likewise of particular interest in this field, and are available for automatic change of sequence of two pumps, automatic change of sequence of three pumps, or the automatic change of sequence in two or more pumps.

In the operation of modern water and sewage works where electrical and mechanical equipment is becoming more and more generally used, and where intermittent operation depends either on liquid level or rate of flow, or some other factor of operation, these electric control systems are of particular interest.

Catalog No. 147 may be obtained from the B/W Controller Corp., 2200 East Maple Rd., Birmingham, Mich.

ACCELATOR



THE

MODERN WATER TREATING PLANT

OVER 600 SUCCESSFUL INSTALLATIONS

The ACCELATOR is new enough to be exclusively different in design, yet old enough to be thoroughly proved in performance.

It is the result of more than a half a century of intensive research and development by Infilco water conditioning specialists.

The ACCELATOR combines in one compact tank the former separate steps of quick mixing, coagulating, settling, and sludge removal.

Raw water and chemicals are intermingled with a constantly circulating well-coagulated slurry, and chemical reaction takes place almost instantly on the surface of old particles. Clear treated water rises at a high rate from the surface of the circulating slurry pool.

Write for Bulletin 1824. INFILCO Inc., 325 West 25th Place, Chicago 16, Illinois.

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Design and Build

OVER 1500

TYPES AND SIZES IN

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● Make Golden-Anderson Valves your first choice on any new or replacement project—for maximum safety, dependability and protection.

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pH Control

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there is nothing like

NON-FADING GLASS COLOR STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

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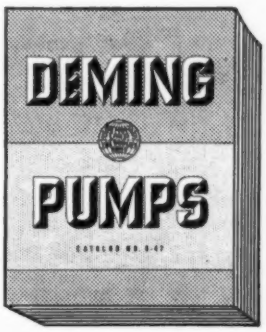
3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.

HEADQUARTERS FOR COLORIMETRIC APPARATUS

Deming Pumps

It takes a 180-page catalog to cover the extensive line of pumps and water systems of The Deming Co. of Salem, Ohio.

This new catalog, No. 6-47, titled simply **Deming Pumps**, presents the pumps in an entirely different arrangement than has previously been used. This catalog shows the industrial line of pumps in the front section, 86 pages being devoted to numerous types of centrifugal pumps, sump pumps, cellar drainers, deep well turbine pumps, high pressure pumps, condensation return units, boiler feed pumps, mine pumps, Triplex pumps, "Turbo-Flo" pumps, and rotary pumps.



In this section are at least seven new pumps, including centrifugal pumps, sump pumps, "Turbo-Flo" pumps, condensation return units, etc.

The balance of the catalog consists of 65 pages of material on Deming water systems for domestic and farm use, and 29 pages on pump accessories and spray pumps.

For the readers' benefit, there are sectional views and exterior views of each type of pump; these are supplemented with detailed description of construction and operation. In addition there is information on performance tables, selection tables, and other useful engineering data relating to various factors about pumps and water systems.

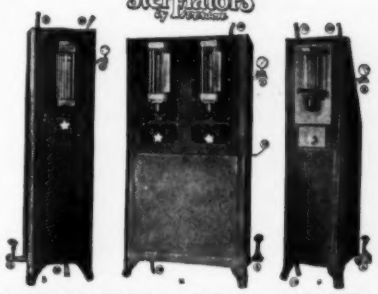
This is a catalog which definitely belongs in the library of every consulting engineer, as well as water and sewage works superintendents. Catalog No. G-47 may be obtained by writing to The Deming Company, Salem, Ohio.

Parabolic Flume

For the open flow measurement of water, sewage, and industrial liquids, the Simplex Valve & Meter Co. recommends the **Simplex Type**

FEED-METERS-MIXES CHLORINE GAS ACCURATELY

SterElators by Everson



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Everson SterElators Operate Manually or Semi-Automatically, Also Automatically Proportion Gas Flow to Water Flow.

Everson SterElators Utilize a 24" Water Gauge Vacuum and Visible Flow Meters, with Wide Ratio Ranges of Capacities: 10 to 1, 50 to 1, 110 to 1.

All SterElators Are Dependable, Accurate, Safe and Easy to Operate. Guaranteed to Give Complete Satisfaction.

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How to join more bell and spigot cast iron water mains per hour ...at less cost

ELIMINATE USE OF HIGH PRICED LEAD

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High lead prices needn't bother you anymore. Use Haymanite. It's inexpensive—goes 4 times as far as lead. Saves 75% of costs.

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Producers also of M. H. Brand Caulking Lead.

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ESTABLISHED 1869

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BUFFALO, N.Y.

S-Parabolic Flume as described in Bulletin No. 210.

This bulletin shows the calibration curve of the parabolic flume, describes its construction, method of installation, and gives capacity tables for different sizes.

The bulletin also contains a section on the Type MS single water float operated meter, which is a standard form used with the parabolic flume.

Bulletin No. 210 may be obtained from the Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia 42, Pa.

Hooker Chemicals

A new edition of the **Hooker General Products List, Bulletin 100,** has been published by Hooker Electrochemical Co., Niagara Falls, N. Y.

The bulletin contains 20 pages of description with principal physical and chemical properties, graphic formulas, uses, and shipping information about the various products of the company.

A copy of Bulletin No. 100 may be obtained from the Hooker Electrochemical Co., Niagara Falls, N. Y.

YOUR NEIGHBOR IS OUR ★ STAR SALESMAN!

Illustration shows use of "Flexible" steel rods and power drive for fast, efficient removal of roots, sand and other obstructions at sewer line distances up to 800 feet.

Actual, economical day-in, day-out application of "Flexible" tools and equipment for sewer cleaning and maintenance is the best possible kind of sales story available. Today, the cities of America that do not use "Flexibles" with marked satisfaction are in a small minority. Check up on "Flexible" performance in your neighboring city.

Most cities, agencies and industrial users of "Flexibles" are recording sewer cleaning savings of between 60 and 80%. Full lists on request.

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100 Per Cent Metering

In the January-February 1947 issue of **The Pittsburgh-Empire Water Journal** appears an article by Mortimer M. Gibbons, Superintendent and Engineer, Board of Water Commissioners, Rahway, N. J. This article is titled *How A Community is Benefited by Metering All Services.* It is a true story of Rahway and Mr. Gibbons has not only described how the metering was done, but has pointed out that metering reduced the daily peak load, saved approximately 16 gallons per day per capita, reduced the state tax, cut the cost of sewage disposal, and at the same time produced an annual net savings of more than $2,000. These are but a few of the eleven beneficial results which Mr. Gibbons found on complete metering of the city.

This particular issue of the **Water Journal** also contains a story about the Western Shore of Lake Superior by H. G. Tischer, General Manager of the Duluth, Minn. Water, Gas and Sewage Disposal Department, and an article on Water Sources for Early American Towns by Karl R. Kennison, Chief Engineer of the Metropolitan District Water Supply Commission, Boston.

The Pittsburgh-Empire Water Journal is published six times a year by the Pittsburgh Equitable Meter Division of Rockwell Manufacturing Co., Pittsburgh, Pa.

Stream Pollution

For the third time in ten months the General Electric Co., in its publication titled **Load** containing ideas and information for power sales engineers, has discussed the subject of stream pollution. In the February '47 issue there appears an article on *Stream Sanitation and the Textile Industry.* The article is written by Dr. Burt Johnson of the Institute of Textile Technology, Charlottesville, Va., and the editor notes that "The issue of stream pollution will confront more and more industries throughout the country as public opinion awakens to the widespread dumping of raw sewage into open streams and waterways." With reference to the textile industry, Dr. Johnson presents the challenge facing this industry and points out that considerable public good will can be obtained by taking steps before legislation forces the issue.

The article covers such sections as the textile industry's responsibili-

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VOGT BROTHERS' TRAFFIC MODEL FIRE HYDRANT

A.W.W.A.

VOGT BROTHERS MFG. CO. Incorporated LOUISVILLE, KY.
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AERO-MIX

AERATOR—MIXER

A Size and Type to Fit Your Problem in Water or Sewage Treatment.

WRITE FOR INFORMATION

SAFETY LUGS FOR COVERS

This worm's-eye view of a Ford Meter Box Cover shows not only the Ford Worm Lock but also two of the three safety lugs provided on all lids. These tend to prevent the lid being kicked off if left unlocked.

Ford Meter Box Covers are made in single and double-lid types, in sizes for 15", 18", 20" and 21" meter box barrels and with various sizes of top lids. Over a million in service.

Write for interesting and useful catalog.

The FORD METER BOX COMPANY, INC.
Wabash, Indiana

ty, pending legislation, treatment problems, the necessity for trained personnel, cooperative approach, waste reclamation, and the chief offenders among various wastes. The Institute of Textile Technology has a research program on stream sanitation in active operation, including pilot plant studies.

Load is published by the General Electric Co. of Schenectady, N. Y.

Universal Feeders

When the Omega Machine Co. speaks of Universal Feeders, they are of course speaking of chemical feeders, and this is especially true in a bulletin titled **Dependable Universal Feeders** which presents three sizes (covering a feeding range of from one lb. to 5,000 lbs. per hour), and shows cutaway drawings of the feeding system and lists the various special features of the feeders.

This bulletin also shows the Weighcheck Feeder, and the bulletin may be obtained by writing the Omega Machine Co., Division of Builders Iron Foundry, 9 Codding St., Providence 1, R. I.

Cold Water Softening

Clear soft water is produced instantly with no settling and no sludge in the **Permutit Spiractor**, according to Bulletin No. 2384 of The Permutit Co. In this 4-page folder appears a description of the design and operating principles of the Spiractor, a sectional drawing of the operation, data on comparing rates of softening in the spiractor with the conventional lime-soda process, various applications of the equipment, and a flow diagram of its installation in a water system.

Bulletin No. 2384 may be obtained from The Permutit Co., 330 W. 42nd St., New York 18, N. Y.

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WALLACE & TIERNAN TYPE MSVM CHLORINATOR

CORNWELL CHEMICAL CORP.
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WILL SELL

all or part 500 tons miscellaneous cast iron water fittings, sizes ranging from 4" to 20", located Jacksonville, Florida.

Phone, Wire, or Write —

Albert Pipe Supply Co., Inc.
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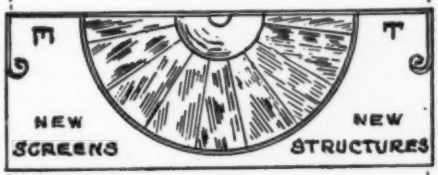
FINE SCREENS FOR SEWAGE AND INDUSTRIAL WASTES TREATMENT



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HIGHEST EFFICIENCIES
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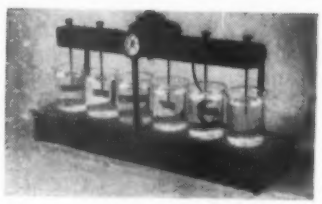
Engineers and Sales Agents



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LABORATORY MIXER

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

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of stainless steel with new bronze thrust roller.
For further information and *free* 5/8" samples
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SURFACE WASH SYSTEMS FOR SALE

Satisfied with your present method of Filter Wash? Send for details. No obligation.

STUART-BRUMLEY CORP.
516 No. Charles St., Baltimore, Md.

Hydro-Foil Pumps

The Peerless Pump Division of Food Machinery Corp. has made an important contribution to the regulation and control of large volumes of water with its development of a mixed flow type of pump.

This mixed flow type pump is described and illustrated in a 24-page bulletin entitled **Peerless Hydro-Foil Pump,** which also contains information on propeller type pumps as well as on mixed flow.

Copies of the new bulletin No. B-148 may be obtained by writing Peerless Pump Division, Food Machinery Corp., 301 West Ave. 26, Los Angeles 31, Calif.

Air Inlet Valves

Bulletin No. 25 titled **Simplex Air Inlet Valves** is published by the Simplex Valve & Meter Co. of Philadelphia, and is the first bulletin ever to contain complete data on the use of air inlet valves.

The bulletin contains complete information on the use of these valves for protection against collapse of thin-walled, gravity flow pipe lines. Nomographs are included for the determination of size and other characteristics, and a complete discussion of the operation is also presented as is information on the construction features. The nomographs replace long, involved formulae and make for simple and easy use.

The booklet also contains information on a combination air inlet and air release valve.

Bulletin No. 125 may be obtained from the Simplex Valve & Meter Co., 6743 Upland St., Philadelphia 42, Pa.

For Sale

One, McIntosh & Seymour Diesel, type 2B-25, Engine #1909, 110 H.P. 2 cylinder, R.P.M. 275, Air injection. This unit coupled to a 3 Cyl. Gould pump size 13x16, Number 49211, Figure 1585, 1000 G.P.M. at 150 lbs. The above unit is 27 years old.

Box 102, Water & Sewage Works, 22 W. Maple St., Chicago 10, Ill.

PUMP UNIT FOR SALE

Allis-Chalmers pump unit, Size 4x3; Type SK; Cap. 500 GPM at 175 ft. TDH; 1750 RPM; Ser. No. 19387. Induction Motor, Type ARY; 40 HP; 3 Phase, 60 Cycle, 440 Volts; 1750 RPM, Continuous, 400 C. Unit in good condition; immediate delivery.

Box 103—Water & Sewage Works, 22 W. Maple St., Chicago 10, Ill.

POSITION WANTED

Supt. Sewage Disposal. Experienced operation and maintenance activated sludge and Trickle Filter plants, lift stations and collection system. Write care Box 104, Water & Sewage Works, 155 E. 44th St., New York 17, N. Y.

BOND-O
Sulphur Joint Compound

Our BETTER BLENDING means that each batch of BOND-O comes out of our machines exactly compounded and thoroughly mixed. Cast iron pipe joints made with BOND-O show this difference. Less initial leakage from every joint made.

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ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

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Pioneer Producer of GREENSAND ZEOLITE MINERAL

STOP JOINT LEAKAGE WITH CARSON CLAMPS
AND MECHANICAL JOINTS
Charcoal iron bolts for Cast Iron Pipe and Fittings.
Write for Prices.
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ALUM FOR SALE—

Satisfied with the power of your coagulant? Send for sample of Activated Alum. No obligation.

STUART-BRUMLEY CORP.
516 No. Charles St. Baltimore, Md.

Iron and Manganese Silica Removal

Methods of removing iron, manganese and silica from water supply are described in two new bulletins published by Liquid Conditioning Corp.

Bulletin No. 6 shows the processes and types of equipment for **Removal of Iron and Manganese,** and Bulletin No. 7 presents methods and equipment for **Silica Removal.**

Copies of either or both of these bulletins may be obtained by writing Liquid Conditioning Corp., Dept. WS, 114 East Price St., Linden, N. J.

Texrope Drives

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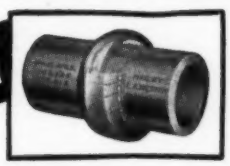

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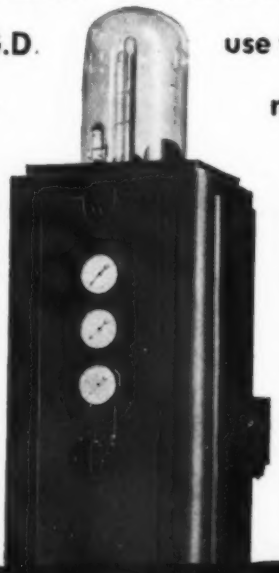

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